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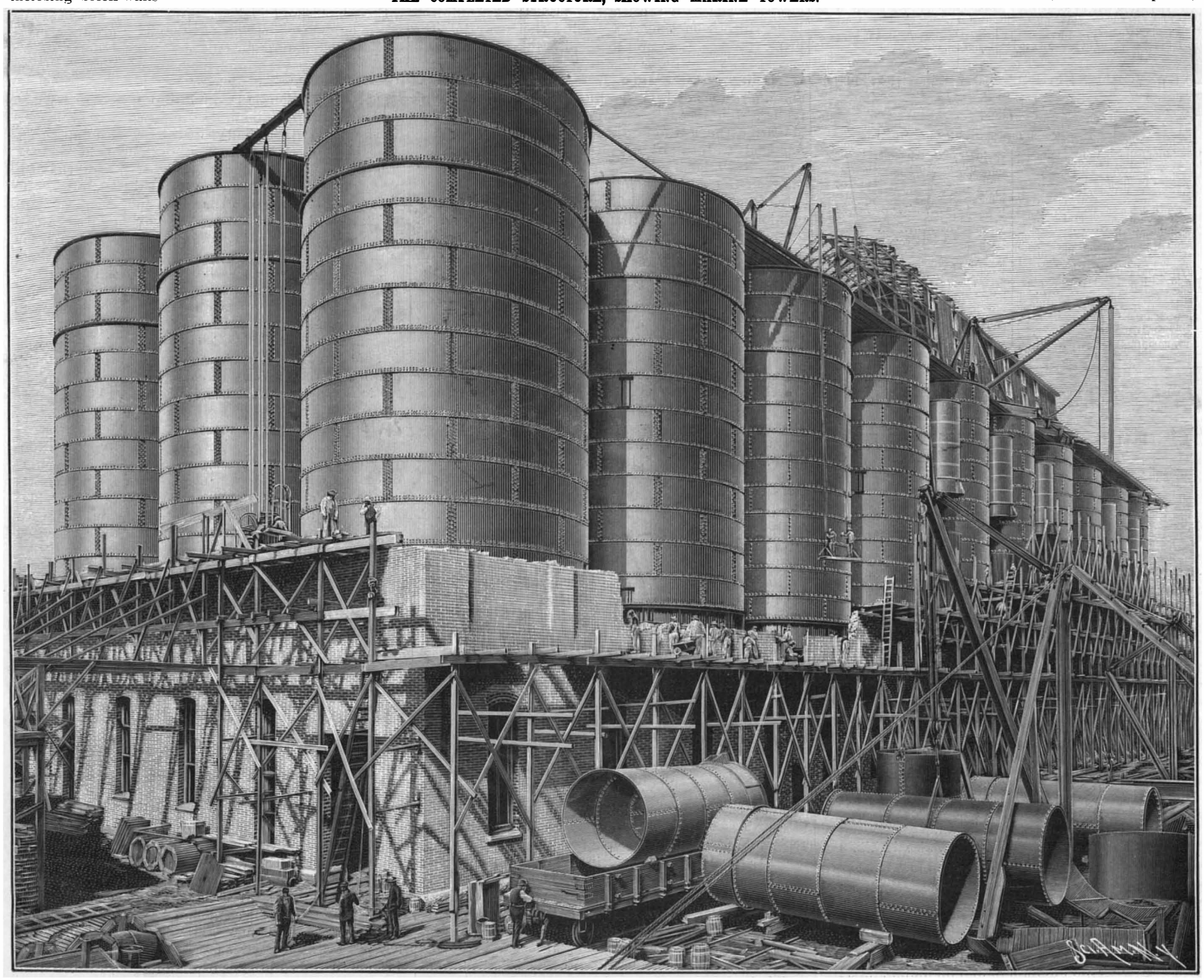
FIREPROOF STEEL AND BRICK GRAIN ELEVATOR.

In our issue of November 20 we gave an illustrated description of the largest of the grain elevators in use at the port of New York. In this issue we present views of the latest and largest elevator in existence, in which an entirely new departure has been taken in substituting steel for wood in the construction of the bins and in driving all the machinery by electrical power. The two engravings show this vast structure during its erection at a time when the cylindrical bins had been built and the inclosing brick walls were being carried up, and also when the building was completed.

THE COMPLETED STRUCTURE, SHOWING MARINE TOWERS.

The elevator, which was built for the Great Northern Elevator Company, of Buffalo, New York, covers an area 120 feet wide by 400 feet long and is located on the Blackwell Canal and Garrison Street, Buffalo. The structure is composed wholly of stone, brick and steel, and there is no wood or other inflammable matter in the building or used in its construction, other than above set forth, excepting the roller top desk of the elevator superintendent, and this is located in his office, which

(Continued on p. 407.)



THE STEEL GRAIN BINS—CAPACITY 3,000,000 BUSHELS.

FIREPROOF STEEL AND BRICK GRAIN ELEVATOR, BUFFALO N. Y.

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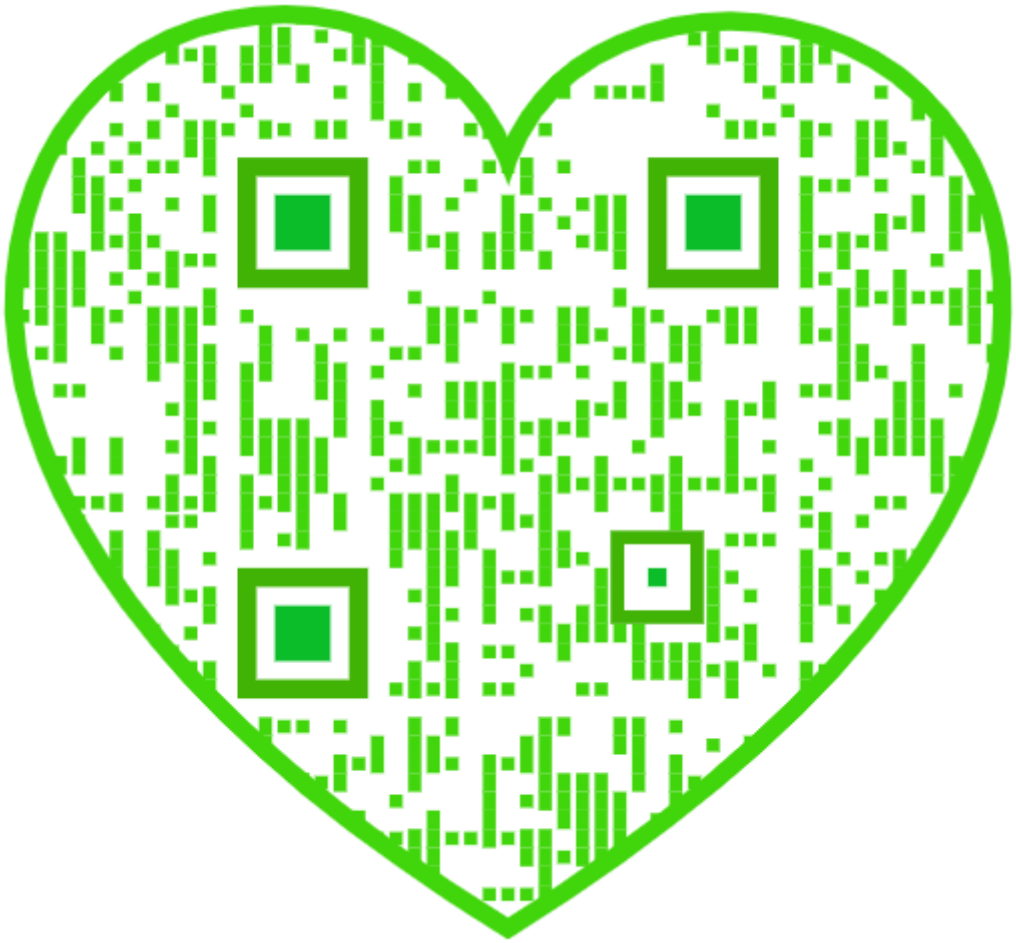

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Contents.

(Illustrated articles are marked with an asterisk.)

Aluminum balloon, the Berlin*.. 405
Archæological news..... 406
Arctic ship "Windward" presented to Lieut. Peary..... 403
Armor plate question, the..... 402
Beet sugar in Nebraska..... 407
Bicycle frame, a cushion*..... 404
Bicycle records, wonderful..... 402
Books, new..... 410
Buildings, dustless..... 403
Caisson dry dock gate, a large*.. 408
Cements, caoutchouc and gutta percha..... 404
Copyright injustice..... 403
Dry dock, Brooklyn, repairing*.. 408
Economy in details..... 402
Electric seismoscope, an..... 406
Electric traction, high speed..... 402
Elevators abroad..... 406
Engineering landmark to go..... 402
Feather evil, the..... 405
Flour, compressed..... 407
Grain elevator, the largest in the world*..... 401
Guns, heavy, "knock-down"..... 408
Human speed and endurance..... 402
Inventions recently patented..... 410
Kansas, a year of plenty in..... 402
Lasso, the..... 403
Navy yard, Brooklyn, dock repairs*..... 408
Notes and queries..... 411
Ordnance, heavy, new method of manufacturing*..... 408
Patents granted, weekly record. 411
Peary, Lieut., receives a ship.... 403
Science notes..... 406
Sleep, inducing..... 405
Steel grain bins enormous*..... 401
Stovepipe holder, Griswold & Chase's*..... 404
Submarine boat, Fulton's..... 404
Wrench, Avery's*..... 404
Yacht service, a transatlantic... 404

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1147.

For the Week Ending December 25, 1897.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AERONAUTICS.—A New Steam-propelled Aeroplane..... 18338

II. BOTANY AND HORTICULTURE.—The Tomato Grafted upon the Potato.—1 illustration..... 18336
The Weeping Spruce.—1 illustration..... 18337

III. CIVIL ENGINEERING.—Enlargement of the Port of Marseilles.—Full details of an important engineering work which includes the construction of an entire new basin.—3 illustrations..... 18331

IV. CYCLING.—Alfred Kocher and His Pace Makers.—1 illustration. 18335

V. HOROLOGY.—Repeating Bells in Clocks.—2 illustrations..... 18329

VI. MECHANICAL ENGINEERING.—The Comparative Advantages and Disadvantages of Steam, Compressed Air and Electricity for Power Purposes in Coal Working, with Special Reference to Coal Cutting and Haulage.—The Iron and Coal Trades Review Prize Essay..... 18331

VII. MEDICINE.—New System for Locating Bullets.—Use of Roentgen photography to accurately determine the position of foreign objects in the head.—3 illustrations..... 18328

VIII. MISCELLANEOUS.—Things American.—By MARCUS BENJAMIN.—An entertaining account of Prof. Benjamin's travels and the souvenirs which are obtainable..... 18335
Electrical Notes..... 18333
Miscellaneous Notes..... 18333
Selected Formulæ..... 18333

IX. PHOTOGRAPHY.—Marine Photography..... 18337

X. PHYSICS.—New System of Locating Bullets.—3 illustrations..... 18328

XI. SOCIOLOGY.—The Musee Social and its Work in Switzerland.... 18334

XII. STEAM ENGINEERING.—Testing a Boiler to Destruction..... 18329

XIII. TEXTILES.—Philadelphia Textile School.—A description of an important textile school equipped with the latest form of textile machinery.—3 illustrations..... 18330
Pineapple Fiber..... 18329

XIV. TRAVEL AND EXPLORATION.—Scenes around Pnom-Penh, the Capital of Cambodia.—1 illustration..... 18334

FAMOUS ENGINEERING LANDMARK TO BE REMOVED.

The laying of the new 48 inch water mains on Fifth Avenue, New York, has reached a point where it is possible to dispense with the distributing reservoir at Forty-second Street, and this famous engineering work will now be torn down to make way for the noble pile which is to form the home of the New York Public Library. The reservoir was built over half a century ago to provide a terminal for the Croton Aqueduct, in common with which it forms the most monumental engineering work of the first half of the century in America. The cost of this water supply was more than $12,000,000, and the enterprise with which the city of only a quarter of a million souls faced so great a financial burden was only equaled by the skill and good taste with which the engineers of that day, Jervis, Allen and Davis, carried out the engineering and architectural features of the work.

The reservoir, which crowns the summit of Murray Hill, stood well out in the country at the date of its erection. Fault has been found with its architectural design; though it has always seemed to us that the simple and massive Egyptian style in which it is built is singularly adapted to express the purpose of the inclosing walls of the structure. The reservoir covers four acres and is built entirely above ground. The walls are carried up high enough to give a maximum depth of 36 feet of water and a total capacity of 24,000,000 gallons. The walls are double, with a space between them, varying from 9 feet 9 inches to 14 feet in width, and they are tied together at intervals with cross walls. The outer wall, 4 feet thick throughout, has a batter of 1 in 6. The inner wall varies from 6 to 4 feet in thickness and is vertical. A puddled embankment is laid against the inside of the inner wall and the bottom is covered with 2 feet of puddled earth, above which is 12 inches of concrete.

The work was carried out with that conscientious care which marks the whole of the Croton water scheme, and testifies to the skill of the engineers and the thoroughness of the contractors of an earlier day.

THE POSSIBILITIES OF HIGH SPEED ELECTRIC TRACTION.

In view of the many impossible schemes for air-line electric roads with speeds of from 100 to 200 miles an hour which from time to time find their way into the press, it is a relief to find the subject taken up and discussed in a scientific way by professional men who have no other object than to place the actual possibilities and limitations of high speed electric travel before the reader. In a recent series of articles in the Engineering Magazine the authors discuss the engineering and financial features of an electric road between New York and Philadelphia which would carry passengers between the two cities in thirty-six minutes, or at the rate of one hundred and fifty miles per hour. It is the opinion of the authors that the scheme would present no civil or electrical engineering difficulties which could not be overcome. The cost, however, as figured out, would be $190,000,000. The estimate is made on the basis of a road on the third rail system, with trains running at three-minute intervals. Three-phase 10,000 volt current would be used for transmission lines, and 1,000 volt direct current on feeders. Each station would have an economical capacity of 30,000 horse power and each substation a capacity of 20,000 horse power. The travel, estimated on the basis of several existing elevated and suburban roads, is put down at 187,040 passengers both ways per day. This is more than four times the traffic of all the existing roads between these cities. It is considered, however, that the reduced time and the low fare, assumed at twenty cents, would greatly increase the travel. It is evident that, in the opinion of the authors, Messrs. C. H. Davis and F. S. Williamson, the difficulties would be rather of a financial than electrical nature, and their study of the question of high speed travel shows once more that the limits to engineering performance are set by financial rather than technical considerations.

PROBABLE SOLUTION OF THE ARMOR PLATE QUESTION.

There is some prospect of a settlement of the armor plate controversy between the government and the firms engaged in armor plate manufacture, by the latter offering to supply a much superior plate at the price fixed upon by the Secretary of the Navy. It is well understood in naval circles that the great Krupp factory is turning out nickel plates treated with its new gas process which have shown better ballistic results than the nickel-steel Harvey plates which have won such world-wide celebrity. It now appears that the Carnegie and Bethlehem Companies have acquired the rights to the Krupp process in this country, and two experimental plates are being made which will shortly be tested at the naval proving station at Indian Head. The Krupp plates have shown all the hardness of the Harvey plates, with a remarkable toughness which renders it practically impossible to break them. Extreme toughness and extreme hardness seemed to be incompatible in the same plate, until Harvey combined the two by the use of nickel and face hardening. The hardness, however, is always present in greater degree than the toughness in Harvey plates. The new Krupp process seems to render the plate absolutely proof against fracture.

If the two experimental plates show all the good qualities expected of them, the obvious course for the government would be to fix a fair price and close a contract for the supply of the much needed armor for the new battleships.

A YEAR OF PLENTY IN KANSAS.

It is a commonplace truth that the source of the prosperity of this country lies in the soil—that good crops mean good times; but it is only when we have before us such astonishing figures as are furnished this year by the Kansas State Board of Agriculture that we appreciate the supreme importance of agriculture. Omitting the odd thousands, we find that the yield of winter wheat in that State is fifty million bushels, worth thirty-four million dollars, or 160 per cent more than last year. The corn crop totals one hundred and fifty-two million bushels, and the yield of oats is twenty-three million bushels, the two together bringing in thirty-two million dollars. The total value of winter and spring wheat, corn and oats is sixty-six million dollars.

This is the record of a year of plenty. Compare it with the crops of the previous year, when the combined winter and spring wheat, corn and oats brought only fifteen million dollars to the farmers.

The table of the yields and values of the crops and products of all kinds, including, in addition to the cereals already mentioned, potatoes, flax, sorghum, dairy products, etc., is one hundred and thirty-six million dollars. The total value of crops and live stock is two hundred and thirty million dollars, and the total net increase of all agricultural products is over forty million dollars. In the presence of such figures one is prepared to believe there may be more truth than jest in the statement that Kansas will "forward a car load of canceled mortgages" to the forthcoming exposition at Omaha as a token of her returning prosperity.

ECONOMY IN DETAILS.

There is a good story told in a Philadelphia paper of a French officer of engineers who, during a visit to one of the large machine shops in that city, regarded with comparative indifference the massive tools and "show" features of the establishment but paid close attention to a little tool-sharpening machine—a type of those numerous ingenious labor-saving appliances with which an American shop abounds. At the close of his inspection he stated that he had visited all the most notable engineering undertakings and establishments in America, and that he should report to his government that the biggest things in America are the little things. He was struck with the fact that in some establishments which he had visited the profits were mainly realized in the saving of materials and labor by close attention to details which in Europe are unconsidered trifles, and as an instance of this he quoted the little grindstone which he had noticed in the shops.

The criticism of the French engineer went direct to the mark, for while we have engineering works as great as any in the world, it is in our genius for invention of labor-saving appliances that we lead the world, and herein, too, lies the secret of the extraordinary reductions which we have been able to make in the cost of manufacture.

With the ever-growing magnitude of industrial operations and the increasing keenness of competition, the race will be won by the people who have a genius for economy in details, who are untiring in their efforts to save time and labor in the most insignificant trifles of shop and factory management. The rapidity with which the new inventions of one country are patented and bought up in other countries has an equalizing effect which prevents any one nation from enjoying a monopoly of the fruits of its ingenuity, at least in the more important and costly inventions; but as long as the American mechanic continues to devise more rapid and less laborious ways of doing even the most insignificant work, it will continue as easy for us to undersell the European producer as it is puzzling to him to understand how we can do it.

THE LIMITS OF HUMAN SPEED AND ENDURANCE.

The many forms of use and abuse to which the bicycle has been put have served to demonstrate that man is capable of feats of speed and endurance the mere suggestion of which would have been deemed absurd and impossible a generation ago. While it has long been known that the human frame was capable of exertion far beyond the powers of the brute creation, it was reserved for the bicycle to show just what the measure of its endurance was. While we consider that six day races, such as have lately been concluded in New York, are to be condemned on obvious grounds of humanity and common sense, it is undeniable that they possess an interest as showing the amazing feats of strength and endurance of which a well trained athlete is capable.

The past year has been fruitful in record-breaking

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performances on the bicycle, and the array of records is full of startling figures. The distinction most coveted by the racing wheelman is that of having ridden the mile in fastest time. This has been done first in England and a month or two later in America in 1 minute 35⅘ seconds, which is equal to a speed of over 38 miles an hour. The rider who first rode a mile in this time has also covered a distance of 32⅘ miles in one hour—an even more remarkable performance.

This, however, was eclipsed by the feat of another speedy rider who wheeled off over 616 miles in one day at an average speed of 25⅔ miles an hour. A study of the details of this ride reveals the remarkable fact that the rider was as strong at the finish as at the start, the average speed for the twenty-fourth hour being as high as for the first hour, and the 610th mile being covered in 1 minute 56 seconds, or at a speed of more than 30 miles an hour.

The latest and, in respect of mere endurance, the most difficult feat was the ride of 1,983 miles in six days made in this city. The average speed from Monday morning to Saturday afternoon, when the rider practically left the track for good, was 14·7 miles per hour, and the average actual speed, exclusive of rests, was 15·8 miles per hour. The rider was off the track only 9¾ hours, 4½ hours of which were given to sleep. From a medical point of view the remarkable fact was that his pulse and temperature were about normal after this tremendous exertion, and that he showed no discernible physical injury as the result of it. It is noteworthy that the rider's diet consisted almost entirely of boiled rice and milk and that no stimulants of any kind were taken.

In the presence of such performances as have been outlined above, the stories of ancient prowess become more credible, and it is certain at least that our race shows no signs of physical degeneration in the present day.

COPYRIGHT INJUSTICE.

An interesting example of the obliquity of vision with which men seem to be afflicted in regard to property rights in literature is given in the pending proposal for amendment of the copyright law. It is proposed to require authors obtaining copyright protection to supply at their own cost copies of their books to public libraries throughout the country. At first only a few libraries are to be designated as recipients of such gifts, four or five in all. But there is no reason why the number should not be indefinitely extended. If the public library in one city is to be thus favored, why not that in another city? The chances are that if the principle is once established, the application of it will be extended until the author is compelled to give a copy of his book to every city, town, village and public school library in the land, or else forfeit his copyright. Or, if not, it would be uncommonly interesting for the authors of the proposal to explain why not.

The system, it is said, will result in the building up of a number of national libraries throughout the country. Yes. If every farmer who wants to have his ownership of his wheat crop protected were required to give a bushel to some government depository in each large city throughout the country, the system would result in the building up of a number of national granaries. If every man who wants his right to his wages maintained were required to pay $1 a week to a government collector in each large city of the Union, the result would be the accumulation of a magnificent surplus in the national treasury. If every man who wants to secure patent rights on a machine he has invented were required to give one of the machines to every city in the land, to be loaned out to the inhabitants for free use, it would be a mighty nice thing for those who want to get something for nothing. And assuredly there is no conceivable argument in favor of the one scheme that does not apply with equal force to all the others. There is no more reason why the producer of literature should be thus mulcted than the producer of any other commodity.

The scheme may have been suggested by contemplation of the Library of Congress, which is thus enriched with copies of all new works, and a desire to create duplicates of it in other cities, and the question may be unthinkingly asked why the author may not properly be required to deposit copies of his book elsewhere, as well as at Washington. To such question the answer is obvious. The book is deposited at Washington, not for the sake of building up a library, but as a matter of record, to complete the act of securing copyright, as an inventor was formerly required to place a model of his machine in the Patent Office, or the owner of real estate has to record his title deeds at the office of the county clerk or register. The process of securing copyright is completed at Washington for the whole country, and does not have to be repeated in half a dozen other cities. There is no justification, therefore, for requiring one of its conditions to be repeated elsewhere. Nor would the scheme have any such result as its projectors seem to suppose. It would build up libraries, but they would not be good libraries. The essential nucleus of every library that is worth housing room must consist of a mass of standard and classic works which are not daily being produced and copyrighted. Libraries secured by the proposed method would be altogether one sided. They would contain plenty of current literature, but no standard works; a host of ephemeral novels and minor poets, but no classics and no encyclopedias. Such a library would be a delusion and a snare. The government would have committed an act of gross injustice and spoliation, and have got no real benefit in return. The plan is a mischievous one from every point of view, and should be heard of only as a "horrible example" of freak legislation which never can be seriously considered.—New York Tribune.

LIEUT. PEARY RECEIVES A SHIP.

The following cablegram, relating to Lieut. Peary's Arctic trip, has been received by the New York Sun:

"A. C. Harmsworth, England's patron of Arctic exploration, has presented his Arctic ship 'Windward' to Mr. Peary and will have her overhauled and sent to America for use in his coming expedition.

"This generous act of Mr. Harmsworth is the latest incident in a series that has shown that England and America are bound in the strongest brotherly ties in their mutual interest in Arctic work. Grinnell fitted out the first and second Grinnell expeditions to assist England in the search for Franklin and his brave companions. America sent the recovered 'Resolute' back to England as a gift. England sent the 'Alert' to America to assist in the search for Greely and his companions. Now Mr. Harmsworth gives Mr. Peary a ship which has been engaged for the last three years in exploring Franz Josef Land."

The princely gift of Mr. Alfred Charles Harmsworth will materially assist Mr. Peary in carrying out his plans of Arctic discovery. The "Windward" is admirably adapted to the purpose of exploration in northern seas. This act of the London newspaper magnate will be another tie which, like the log of the "Mayflower," will tend to still more unite the people of Great Britain and the United States.

In 1894 Mr. Harmsworth equipped the Jackson-Harmsworth expedition at a cost of $125,000. This expedition, after spending three winters in Franz Josef Land, returned to England in September last. As the result of their labors almost the whole of Franz Josef Land has been carefully mapped, and has been shown to consist, not, as was supposed, of large land masses, but of a number of islands. Gillies Land, as to which there had been much controversy, he found to be conspicuous for its absence in the place usually assigned to it on Arctic maps.

THE LASSO.

The lasso is of great antiquity. It is said to be depicted in the ruins of Nineveh. An early Persian manuscript, preserved in the Escorial, shows a sportsman (whom I suppose royal by his Olympian expression and careless seat) in the act of catching a wild ass with a nicely plaited lasso. The monarch bestrides a rather "stocky" looking, dark colored horse, with four white feet and a white face. A bow, quivers and a saber are hung from his saddle, and a sort of housing half covers the horse. How the wild ass is to be restrained, even by the hand of a monarch, is not at first sight evident, for the lasso is neither fixed to the saddle after the fashion of the gauchos, nor is a half turn taken round the pommel, in the style adopted by vaqueros in Mexico and Texas. Apart from this detail, all is as realistically set forth as it would be to-day in a photograph. The horse bears away from the beast lassoed, and the king sits a little to one side, exactly as a Texan cowboy or an Argentine gaucho sits under similar circumstances. Irises and Narcissi spring up under the horse's feet, and an applauding group of angels peep out of a cloud, while in the middle distance another Persian gaucho shoots an antelope with an arrow while galloping at full speed.

The Laplanders are said to lasso their reindeer, and the Tartars and modern Australians use a rudimentary lasso fixed to a long pole in order to catch wild or refractory horses. The Poles, Croatians and Wallachians, with the Hungarians, seem to have used the lasso till about the beginning of the present century. A picture by the German artist Richter shows Polish remounts for the German cavalry being lassoed in the Zwinger, at Dresden. The horses look as wild as a Texan "broncho" or an Argentine "gagual," and the attitude of men and animals, and the way the ropes are coiled and thrown, are identical with those adopted in Spanish America to-day. The lasso appears to run through a ring in the pommel of the saddle. It is, however, in Spanish America where the art has been most developed. This is on account of the open country and the vast numbers of wild and semi-wild horses which, up to the middle of the present century, overspread its plains.—Badminton Magazine.

THE Boston Pneumatic Transit Company opened their pneumatic tube system at the general post office, Boston, on Friday, December 17, 1897, at 12 o'clock.

DUSTLESS BUILDINGS.*

BY C. J. WOODBURY, BOSTON, MASS., MEMBER OF THE SOCIETY.

The increased height of office buildings rendered possible by what Otis Tufts patented as the vertical railway, while bringing to their occupants relief from the noise of the streets, and affording comfort by extending above the fly belt, which is as well defined as the snow line on a high mountain, also exposes the occupants to the fine dust which pervades the whole structure and which the other salutary conditions of the building render more prominent.

The modern method of heating and ventilating such a building is by means of a blast of air drawn down a flue, warmed and forced through the building in such quantities that four times the volume of the building is frequently circulated through the rooms each hour.

This method of heating, although a more efficient application of radiating surface for heating the air than by direct radiation in rooms, and can be managed with far less expense for attendance, repairs and fuel, and provides the sanitary requisite of ventilation without cold draughts, yet this apparatus distributes large amounts of dust through such a building; and in a city using bituminous coal under the average conditions there is a fine carbon dust which is especially obnoxious, impairing drawings, books, delicate mechanism, and whatever may be injured by the shower of fine, impalpable dust, which produces black, indelible smutches whenever touched. This carbon dust is always an annoyance and at times a serious matter.

The writer undertook to abate the difficulty of dust in a building of nearly 500,000 cubic feet capacity, through which 26,000 cubic feet per minute was usually blown, for heating and ventilation. The outside air used for this purpose was drawn down a flue 37 square feet in cross section, and reached a velocity of 700 feet per minute.

The means taken to remove the foreign substances from the air were by use of cotton cloth filters so arranged that the air should approach the fabric at an acute angle by which the momentum would carry these particles beyond a point where the element of air under consideration would pass through the filter, and the particles of dust would be carried by the place, and, striking the cloth at a lesser angle, tend to glance off and be carried to the bottom of the filter, rather than to clog the interstices in the fabric. The area of the filters being larger than that of the flue, the rate of filtration was inversely slower than the velocity of the air down the flue.

The means by which this was accomplished were very simple. A timber frame, divided by partitions into fine rectangular openings, was placed at the top of the flue, and under each opening was placed a bag whose top was attached to a light wood frame slightly larger than the opening, making a tight fit, so that the air entering the flue must pass downward into these bags, which were over thirty feet in height. An arrangement of guides, ropes and pulleys enabled the bags to be raised and lowered by a person at the bottom of the flue. The bottoms of the bags were made open, and closed with a drawing string, and hoops kept the lower portion distended. An arrangement of lines extending along the sides from end to end facilitated turning inside out and back again when they were being cleaned.

The whole of the mechanical arrangement is fully described in United States patent No. 589,772.

These bags were square at the top, where their combined area equaled that of the flue, but soon diminished to a cylindrical section, occupying about 40 per cent of the space, thus affording ample clearance for the exit of the air passing through the fabric.

The area of the flue was 3¾ per cent of that of the bags, and while the air passed down the flue at a velocity of 700 feet per minute, it passed through the fabric at 26 feet per minute.

From half a peck to a peck per month of fine dust was gathered from the bags.

The efficiency of the device was tested by placing freshly painted boards at the bottom of the flue before the installation of the apparatus, and then giving another coat of paint after the apparatus was in service.

In the first instance the fresh paint collected fine dust until it resembled fine sandpaper, and in the second the paint dried with a smooth surface.

In several of the offices split laps of absorbent cotton were placed in various parts of the building before and after the bags were in service, and one set was covered with fine particles and the other was free. The change was not a notable one at first, owing to the large amount of dust in the flues, but much of this was removed by running the blower at a very high rate of speed, and afterward removing the registers and washing them and the flues as far as could be reached.

The device has been solely under the care and management of the men employed on the engine and boilers, and has served its purpose in rendering a building free from dust caused by the ventilating system.

* Presented at the New York meeting (December, 1897) of the American Society of Mechanical Engineers, and forming part of volume xix of the Transactions.

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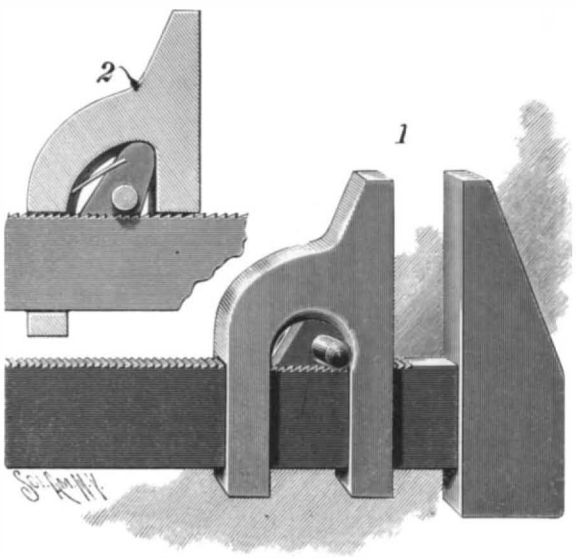
A NOVEL MONKEY WRENCH.

The illustration represents an improved wrench recently patented by Charles H. Avery, of No. 9 Linden Street, Binghamton, N. Y. Fig. 1 represents the working portion of the wrench, the handle not being shown, and Fig. 2 is a sectional view through the movable jaw. The latter, as will be seen, has a seat or re-



AVERY'S WRENCH.

cess, in which is located a clutch member, having at each side a slightly projecting ear. The teeth on the shank or stem of the wrench are inclined in the direction of the fixed jaw, and the clutch member, with the movable jaw, is held in engagement with the teeth by a spring. The arrangement permits the free move ment forward of the movable jaw, to engage a nut, while by a slight pressure on the ears of the clutch member the latter may be released from such engagement and the movable jaw moved backward, as desired. When the ears are released, the spring throws the clutch member into engagement with the stem and holds the movable jaw against movement away from the stationary jaw.

Fulton's Submarine Torpedo Boat.

Nearly a century before Jules Verne wrote about the Nautilus, Robert Fulton constructed a submarine boat of that name. This fact is not generally known, and the recent memoir of M. Eugene Debosc, of the French navy, is of more than usual interest. He states that Fulton launched a submarine boat named the Nautilus at a point near Rouen on July 30, 1800.

"On the same day," he continues, "Fulton made several experiments with his boat. They lasted for three hours, and the stretch of water occupied was between Bapannul and the woodyard of Citizen Thibault, where the depth was twenty-five feet. The experiments were as satisfactory as could be desired, in spite of the fact that there was a strong current. Next day the inventor went down the Seine to Havre, where the new harbor was placed at his disposal.

"There a test was made as to the relative advantages of oars and of a screw moved by the arm, and the result was a convincing proof that by means of the screw much muscular force could be utilized. Seven minutes were required to work the Nautilus by means of oars and only four minutes by means of a screw, which Fulton styled a machine 'with wings like a windmill.'

"When a certain quantity of water was introduced the Nautilus sank readily, and in a direction parallel to herself, and she again came to the surface when the water was forced out by means of a pump. Some time afterward Fulton adopted a screw with horizontal wings, which was placed in front and which enabled him to remain under water almost constantly, even while the boat was moving. He moved to right and left by means of an ordinary rudder placed at the poop, and he also used a horizontal rudder divided into two parts. This method of steering, invented by him, is very like that which is used in modern submarine boats."

Finding that the French government would give him no aid, Fulton, who had spent a great deal of time and money in perfecting the Nautilus, crossed the channel and offered his invention to the British government.

But in London he met even with less success than in Paris. Pitt seems to have thought well of his proposition, but, powerful though he was, he failed to gain for it official approval.

HERR MARPMANN has found microbes of various kinds in seventy-seven samples of ink--red, blue and nigrosine—supplied to schools, and some of the microbes were deadly enough to kill mice inoculated with them. He recommends that ink bottles should not be left open to the air in schools.

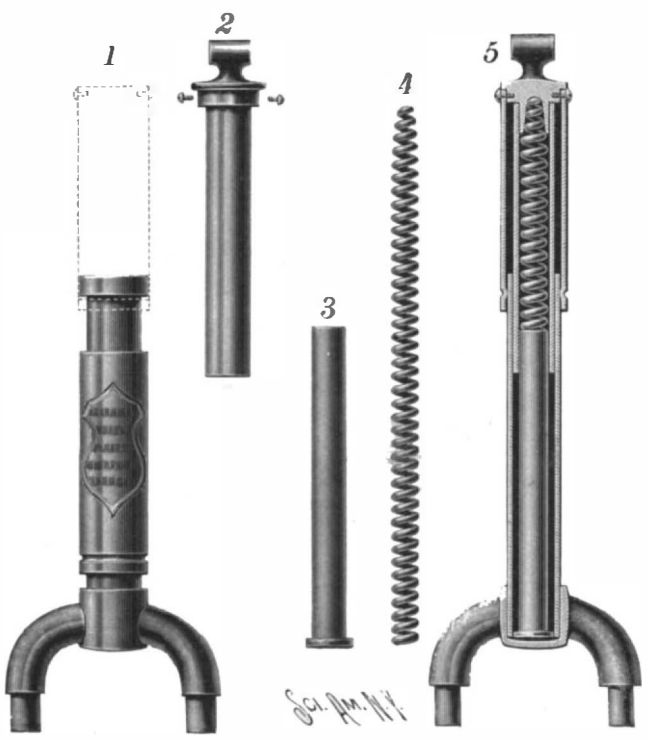
THE PIERCE PNEUMATIC CUSHION BICYCLE FRAME.

The accompanying illustrations represent improvements in a bicycle frame designed to throw upon the wheels all the vibration of a machine, relieving the rider of the most fatiguing part of the work of bicycle riding. The principal view shows the frame assembled, the other figures representing the detached parts which form the cushioning device, the steel tubing being of a high quality, especially drawn for this purpose.

The lines of the cushion frame are those of the best and latest wheels, the frame being of rigid construction, and the portion forming a part of the rear upright would not be noticed as differing from a regular pattern of frame, except for the nickeling. The inprovement is being introduced by the George N. Pierce Company, of Buffalo, N. Y., under the patents of the Hygienic Wheel Company, St. Paul Building, New York City. Messrs. Pierce & Company are manufacturers of cycles and tandems, and also have branches in New York and Boston. The rear upright is, as will be seen, formed as a combination telescopic device, having but slight motion, but with a cushioning arrangement for the rear portion of the saddle formed partly of a spring and partly of compressed air in the tubes.

It is, however, wholly unlike spring seat posts or spring saddles, as the distance is always uniform between the seat and the pedals, the feet and limbs not being vibrated, and the rider being thus saved from excessive jolting on uneven roads—an improvement which cannot fail to be especially appreciated by women riders. In the illustration showing the various parts, Fig. 1 represents the lower tubular socket on the rear fork, Figs. 2 and 3 forming inner tubular portions constituting a pneumatic socket and casing for the spring, 4, while Fig. 5 is a sectional view showing the parts assembled. It is to be noted, also, that the connection between the head and the rear fork is made by means of steel plates, which give great firmness and yet afford some degree of elasticity. It is said that with this improvement the tires can be blown to any degree of hardness without causing discomfort to the rider.

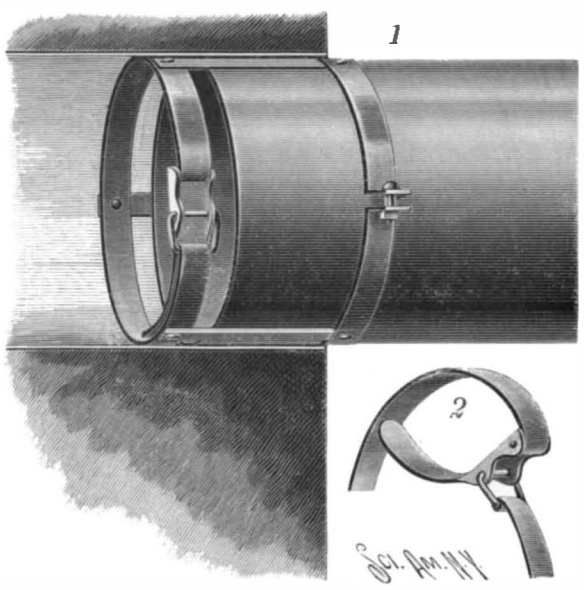
The improvement has already been in use for a sufficient time to have received high commendation from a great number of practical wheelmen. The company make the springs of four different sizes, as may be required by heavy or light riders.



THE PIERCE PNEUMATIC CUSHION BICYCLE FRAME.

A STOVEPIPE HOLDER.

A simple and inexpensive form of holder, readily applicable to one end of a length of stovepipe, and which may be contracted to be conveniently entered into a thimble in a flue or into a pipe opening, to hold the pipe in position, is represented in the accompanying illustration. The improvement has been patented by George Griswold and Harry P. Chase, of Salem, Oregon. Fig. 1 shows the application of the device, Fig. 2 indicating the movement of the inner expanding band. The two bands are pivotally connected by metal straps, each end of the outer band having an ear adapted to receive an adjusting screw by which it may be made to closely grip the pipe. The inner band has at one end a link, while at its opposite end is pivoted a curved lever, as shown in Fig. 2, whereby the band may be contracted for introduction into the stovepipe



GRISWOLD & CHASE'S STOVEPIPE HOLDER.

thimble or flue opening, the lever being afterward thrown back, as shown in Fig. 1, to expand the band and cause it to serve as a support for the inner end of the pipe.

Caoutchouc and Gutta Percha Cements.

A gutta percha cement for leather is obtained by melting together 100 parts gutta percha, 100 parts asphalt or pitch, and 15 parts oil of turpentine. It is to be used hot.

Elastic gutta percha cement, especially for fixing soles to shoes, which does not crack in bending, on account of its great extensibility, is prepared by dissolving 10 parts gutta percha in 100 parts benzine and pouring the solution into 100 parts linseed oil varnish, shaking well. The leather must be roughened before using this cement, in order to insure greater durability. By a caseine-borax cement a handsome surface gloss is imparted to the leather. The borax is dissolved in boiling water and the borax solution poured into freshly prepared caseine. The durable thick cement is very serviceable.

Good caoutchouc cements, for rubber strips or rubber goods on metal, are obtained by dissolving shellac in ten times its weight of ammonia. After standing for three to four weeks a transparent putty results, which is used without heating. The cemented places soften at first, but become hard and firm after evaporation of the ammonia, which may be assisted by heating. This cement is watertight and gasproof, and is also useful for hard rubber articles. A cement made of a mixture of gutta percha with asphalt is serviceable for the same purpose. This has to be applied hot and the pieces are to be pressed together.

Very useful cement for leather belting is manufactured by kneading 10 parts carbon bisulphide and one part of oil of turpentine with gutta percha until a thick paste results. The portions of the leather where the cement is to be applied must be unoiled and roughened; the cement is put on and the ends are pressed together until the binding agent has become dry. Directions for caoutchouc cements are: 100 parts finely cut caoutchouc, 15 parts resin, 10 parts shellac, dissolved in sulphide of carbon. One part caoutchouc, 7 parts mastic, and 50 parts chloroform, left to stand several weeks.

Cement for rubber boots, etc: (1) 10 parts caoutchouc dissolved in 250 parts chloroform; (2) 10 parts caoutchouc, 4 parts resin, 40 parts oil of turpentine, mixed and dissolved. For use, pour together equal parts of both solutions.—Translated from the Färben Zeitung.

JADE is found in the Bhamo, Chindwin, and Katha districts in Upper Burma. The chief workings are in the Bhamo district, from which 254,000 pounds were obtained in 1895. Nearly all of this is sent to China, where jade stone is highly valued.

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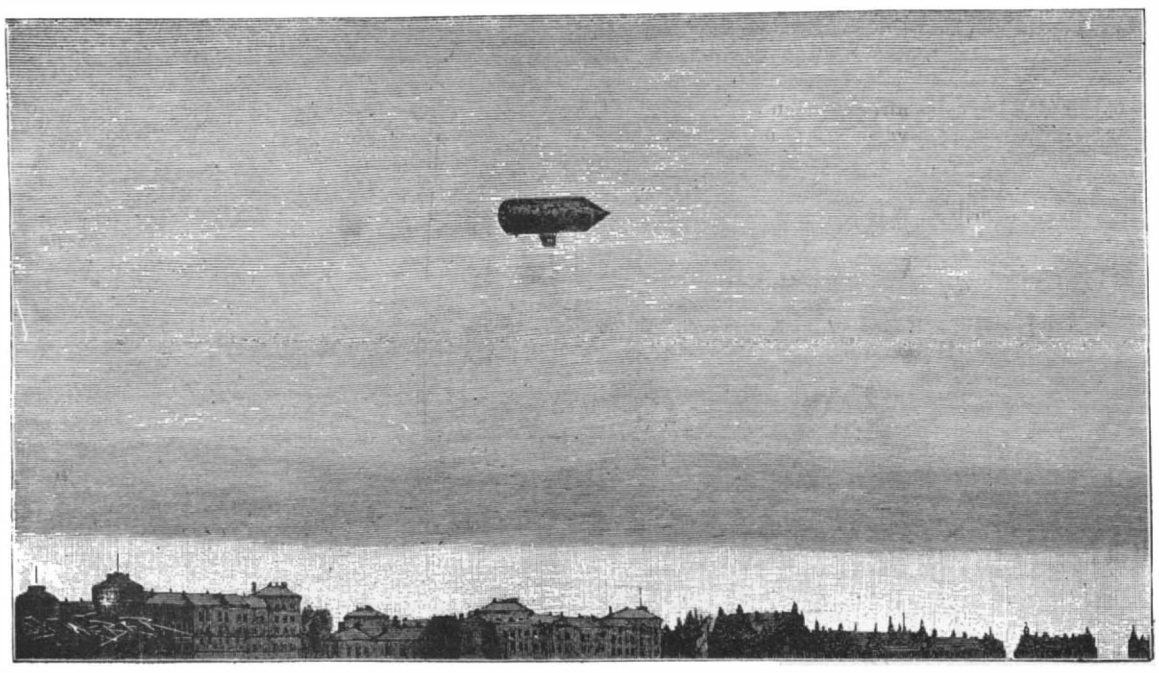
The Feather Evil.

All moralists have assured us that "when lovely woman stoops to folly," she stoops very low indeed. And so when women attempt to emulate the glories of a Choctaw chief or a South Sea islander, it is not considerations of art or humanity or self-respect that will stop them, says Natural Science. Consequently, it is not likely that the insensate votaries of fashion, who disfigure their heads with baskets of artificial flowers (irrespective of the season), virulently dyed scraps of ribbon, twists of steel, and unnaturally clipped or colored bird feathers, will pay any attention to a paragraph in a scientific journal. But we are willing to leave the irresponsible half of creation all their chiffons, their coal tar dyes and their scrap iron, if only they will leave us our birds. The rate at which some of the rarest and most beautiful birds on our planet are being destroyed to gratify this extraordinary taste can hardly be realized. On the 13th of April last nearly half a million birds were sold at an auction in London, and the details of the consignment were thus given by Mrs. Edward Phillips at the annual meeting of the Selborne Society:

Osprey plumes	11,352	ounces.
Vulture plumes	186¾	pounds.
Peacock feathers	215 051	bundles.
Birds of paradise	2,362	
Indian parrots	228,289	
Bronze pigeons, including the goura	1,677	
Tanagers and sundry birds	38,198	
Humming birds	116,490	
Jays and kingfishers	48,759	
Impeyan and other pheasant and jungle fowl	4,952	
Owls and hawks	7,163	

A similar sale took place in February, and others were to follow in July and October.

It is small consolation to us to think that in a few years the price of these luxuries will be prohibitive, or that, unless fashion changes in the direction of seaweeds or turnip tops, there will soon be no more birds to destroy. Nor can we overlook the terrible suffering involved by this enormous slaughter: the young osprey bereft of their parents left to die in hundreds, the heron with the plumes torn from its back, writhing into death.



BALLOON AT ELEVATION OF 800 FEET.

A New Method of Inducing Sleep.

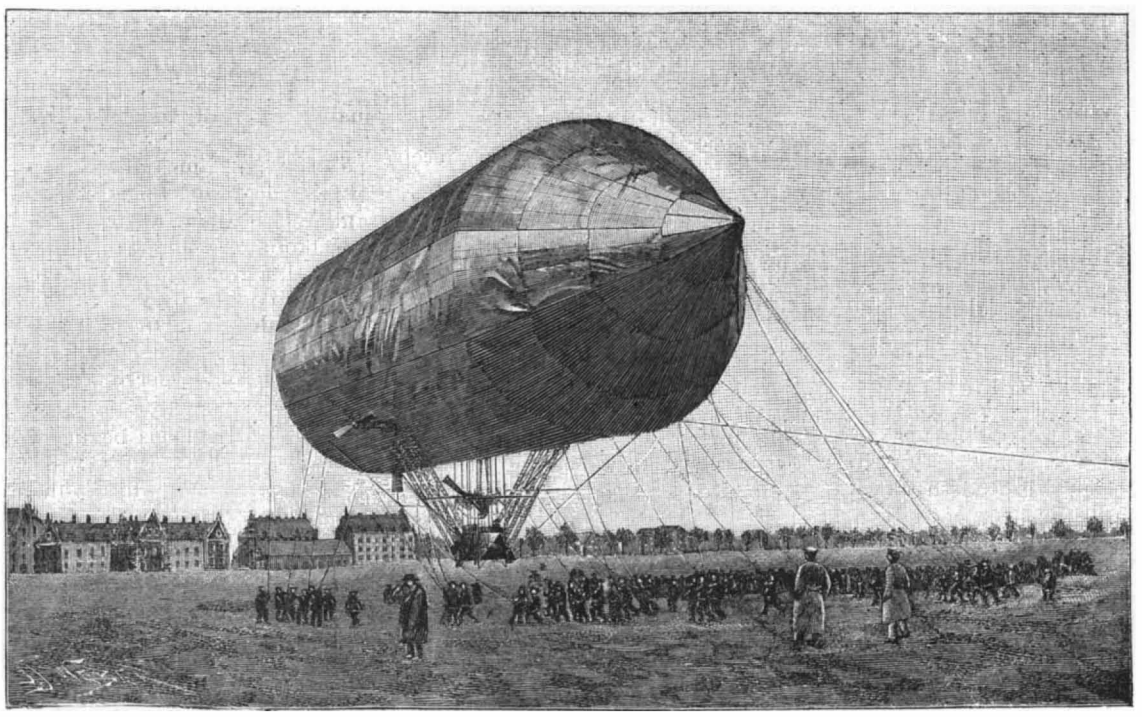
In the Journal of the American Medical Association of September 25, 1897, Dr. J. B. Learned describes the following method, which he used in his own case. For some years he suffered from insomnia following a fall from his car. He tried many methods of treatment in vain—drugs, hot water and cold water internally and externally, friction, over-feeding and under-feeding, exercise, gymnastics, deep inspirations and numberless mental occupations. At last the following method proved a success. The principle is to induce muscular fatigue by exercises carried out in bed. Lying on his back, the patient first reaches for the foot and head board at the same time. He then raises his head half an inch; at the same time he breathes slowly and deeply about eight inspirations to the minute, which are counted. After about twenty inspirations, the head, which begins to feel heavy, is dropped. The right foot is then raised (the reaching for the boards and counting being continued) and similarly dropped when fatigued. The left foot goes through the same process. The muscles which are used in reaching for the head and foot boards are then relieved, and the body is elevated so that it rests on the head and heels. He then turns on the right side and reaches for the head and foot boards again, and raises first the head and then the foot as before. The same process is gone through on the other side. Thus eight positions have been assumed and a large number of muscles used. If sleep has not been induced, the same cycle is gone over again.

THE BERLIN ALUMINUM BALLOON.

The idea of constructing a metallic balloon is not by any means new, the first of this type having been constructed by M. Mares-Monges in 1842. It consisted of a large hollow ball, 33 feet in diameter, built of thin sheets of copper, and filled with hydrogen gas.

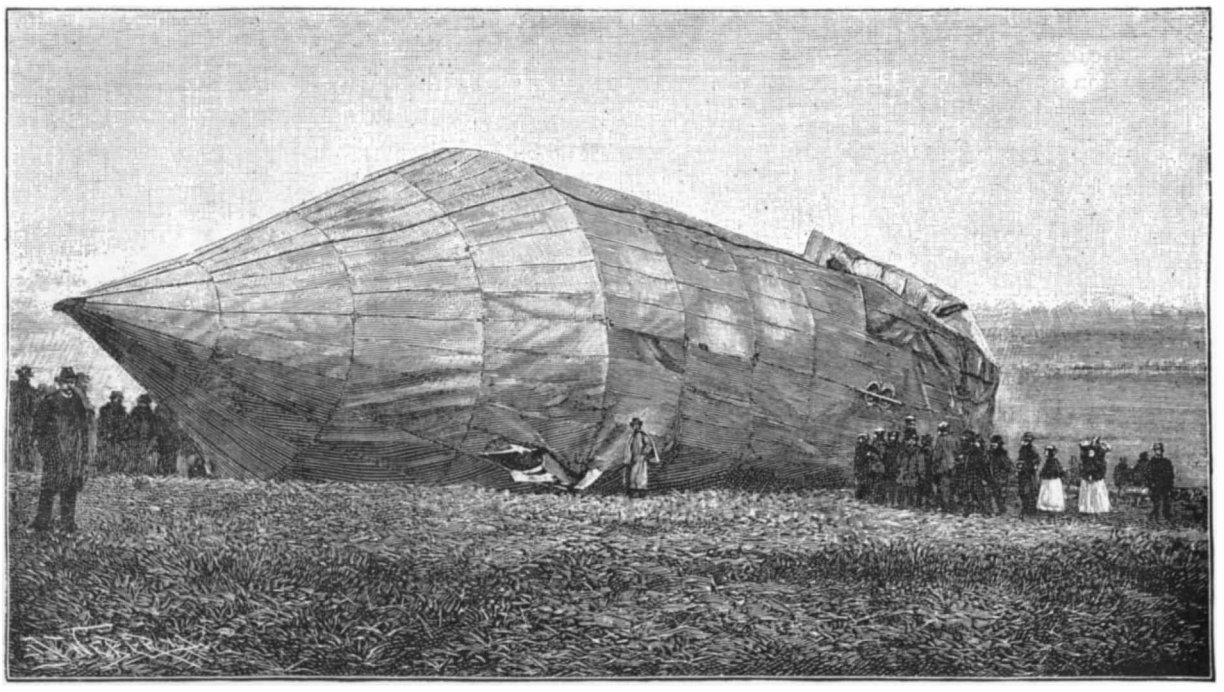
The progress in the manufacture of aluminum and its ever decreasing cost have led experimenters in aeronautics to regard it as a suitable material for balloon construction, and Herr Schwarz, of Agram, designed and built a cylindrical airship of colossal dimensions which recently made a trial trip that ended in disaster.

With the exception of the driving belt, which was of leather, and the bearings, which weighed only a few pounds and were of brass, the whole of the immense structure was built of aluminum. An idea of the true meaning of this can be gained from the following figures: The body of the ship was 134 feet long, 46 feet high, 42 feet 7 inches wide, and the whole ship with the car weighs 5,720 pounds.



START OF THE ALUMINUM BALLOON.

The history of the trial trip, made on November 3, under the direction of the officers of the Royal Prussian Aerial Navigation Department, would probably have been quite different if the inventor and constructor of the balloon had been in the car; but, unfortunately, Herr Schwarz, of Agram, died before the test had been made. The press has made altogether too much of the unfortunate but entirely unnecessary wrecking of the ship, without setting forth the causes thereof; although the ascension, in spite of the unlooked-for ending, demonstrated all that the inventor had claimed. This is the professional opinion, which could be obtained only after some delay. Schwarz had never been able to persuade the officers of the Aerial Navigation Department that his ship had sufficient lifting power to rise from the ground with its motor and passengers; and they maintained that, even if the exceedingly delicate operation of filling the balloon with pure hydrogen by Herr Schwarz's method could be successfully performed, it would be found that the ship was so constructed as to be too heavy to rise. Upon the sudden death of Herr Schwarz, it seemed that his work had been in vain, but his wife, inspired by an unswerving faith in her husband's theories, undertook to complete what he had begun. She obtained permission from the minister of war to have an ascension of the apparatus from the Luftschifferpark under military protection, and the officers of the department afforded her most efficient aid; but she could not overcome their doubt of the lifting power of the ship, and, therefore, in constructing the apparatus, they did away with everything that seemed to them to be at all superfluous. Unfortunately, in this category were included the arrangement employed by Herr Schwarz for securing the driving belt for the wind propellers, the device for regulating the descent and the device for lengthen-



AFTER THE WRECK.

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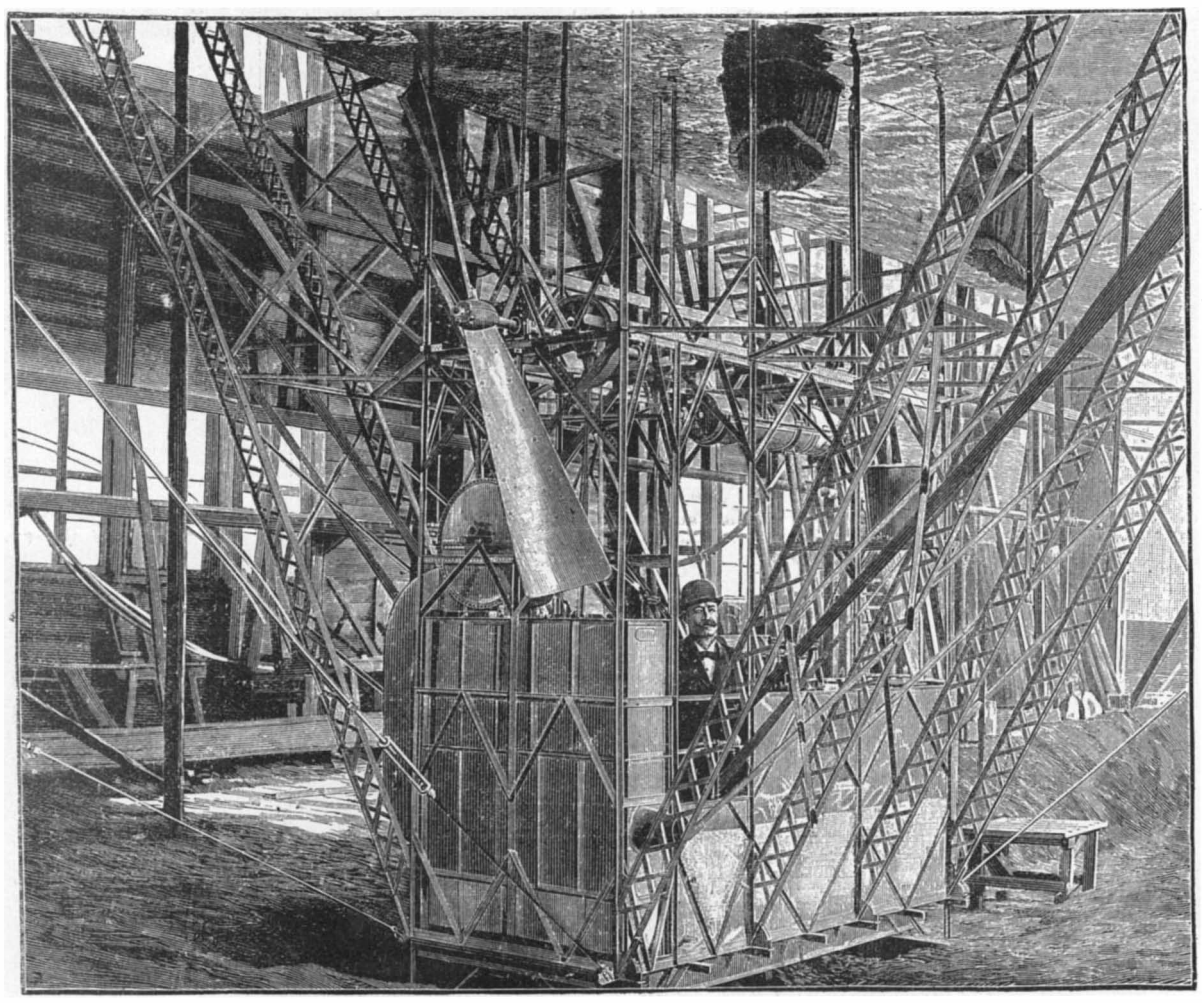
ing the four feet of the car to lessen the shock in landing. It is a fact that the ship became unmanageable on account of the slipping of the driving belt, and then the courageous but inexperienced young man who had been chosen because no better captain could then be found, lost his head, and instead of operating the rear screw alone and trusting himself to the wind, as one would do with a free balloon, he opened the valve wide, thus causing the sudden descent. The absence of the device for regulating the descent and the device for throwing out the feet caused a great shock when the airship struck the ground, so that it was completely wrecked.

As far as the lifting power was concerned, it was demonstrated that the apparatus had too great an ascending power for its light load. It could have carried not only the parts which were left off with such disastrous results, but three or four passengers instead of one, besides much more ballast than was put upon it. The calculations of the inventor have proved to be perfectly correct; and furthermore, it was demonstrated that the ship could be filled by the Schwarz method, which many had declared to be impossible; and finally it was proved that the apparatus could be controlled. In spite of the immense surface that it presented to the wind, it attained a high speed while the motor was working at only half power. Moreover, it rose to a height of 820 feet against a strong wind, and started forward, but this movement was interrupted by the slipping of the belt, and the ship was brought to its untimely end by its operator in the manner already described. The fact that the officers of the Aerial Navigation Department, Frau Schwarz and her friends have courage to immediately begin the construction of a new ship, for which military protection has already been secured, shows that the principle on which the construction of the apparatus is based is considered correct and practical.

For our illustrations and particulars we are indebted to Le Monde Illustré and Ueber Land und Meer.



CAR AND DRIVING MECHANISM OF SCHWARZ ALUMINUM BALLOON.

Elevators Abroad.

It is a curious fact that we do not hear of more serious elevator accidents in Europe. Of course, the larger hotels and stores have elevators which are in the hands of competent people who operate them; but in many small hotels and private houses and shops the "lifts" are operated entirely from the ground floor. When a person wishes to go up in the elevator he tells the attendant the number of the floor he wishes to stop at. An index is moved to that number and the car is started up. When the car reaches the proper floor, the elevator stops and the door is unbolted by the car itself. These "lifts" afford many chances for accidents; thus as the car passes each floor the door into the elevator shaft is unbolted automatically for an instant until the car begins to rise past the floor. It is possible for a person to open the door at this time and fall into the elevator shaft. Probably the most curious elevator in Europe is the one in the Ufizzi Palace, at Florence, which takes up passengers to the picture galleries. One franc is charged for the use of this elevator, and visitors are frequently asked to get into the elevator when it is making the downward trip to give it sufficient weight to reach the ground floor.

New York Rapid Transit.

By a decision, December 17, of the Appellate Division of the Supreme Court, it would seem that the greater part of the opposition to the building of the underground rapid transit lines so much needed in New York City has been met and overcome. The plans of the Rapid Transit Commission, so laboriously and carefully perfected, and so long opposed in the courts, have been passed upon and confirmed by the court, but a clause of the decision stipulates that the commissioners must exact a bond of $15,000,000 from the contractors who are to construct the road, and another clause disclaims any consideration of the question as to whether or not such construction will involve the city in debt beyond the constitutional limitations imposed.

Recent Archæological News.

"La Scala," the famous opera house of Milan, is in danger of being pulled down. It is a serious drain on the box holders. The theater is too large and inconvenient for modern tastes.

After many efforts, the thickly inhabited quarter of Athens known as Anaphiotika, lying immediately under the Acropolis, has been condemned by the government and turned over to the Greek Archæological Society for the purpose of excavation. The inhabitants will receive compensation and will be settled in the suburbs.

Another important archæological discovery has been made in Russia, at Maikop, in the northern Caucasus, where, in a burial mound, a great quantity of gold and silver ornaments has been found, probably belonging to some Scythian king, and dating centuries before Christ. There are gold rings, ornaments, jewelry, silver tankards, bronze axes and other interesting objects.

The Egyptian Exploration Fund has begun the preparation of the first annual volume, which will consist of three hundred pages, quarto, and will be illustrated by plates. The new "Sayings of Christ" have already been published, and the selection from the unexampled discovery of thousands of papyri found last spring promises to be most interesting. Every subscriber of $5 or more will receive the volume, together with interesting reports. Subscriptions may be sent to the Rev. W. C. Winslow, honorary secretary, 525 Beacon Street, Boston, Mass.

Last Issue of the Year—Renewal Subscriptions Now Due.

We take this opportunity to remind our old friends and readers that with this issue many subscriptions will expire, and, in order to prevent any break in the receipt of the paper, it is advisable to remit for the new year without delay, and we also believe that those who are not receiving the SUPPLEMENT would find themselves repaid by subscribing for this journal also, and getting the advantage of the combined rates.

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Science Notes.

Dr. A. Grigorjew believes that the exciting cause of hydrophobia is not a bacterium, but a body belonging to the Protozoa. He has isolated from animals suffering from rabies a body with slow amœboid movements and exhibiting extension of pseudopodes. Its action may even be modified by the presence of bacteria.—Centralbl. f. Bakteriol. u. Parasitenkunde, 1te. Abtheil., xxii, 1897, p. 397.

Herr Goldstein has reported to the Berlin Observatory (Germany) that he is able by the means of cathode rays to imitate experimentally various phenomena observed in connection with the study of comets, such as the luminous radiation of the nucleus and the formation of the tail. He has also been successful in his attempts at reproducing some of the more recently observed effects.—Revue Scientifique.

Another Danish expedition to the Pamir regions will be fitted out next year. Its object will be to make geographical and ethnographical explorations in the northern part of the Wakhan Valley. The expedition will be under the leadership of Lieut. Olufsen, and will include two scientific experts. Its cost will be partly borne by the Danish government out of the Carlsberg Fund, and the explorers expect to be absent for two years.

The issue of a special stamp in England, sold in aid of the Prince of Wales Hospital Fund, was so successful that it is decided to do it annually. It is not likely that philatelists all over the world will care to tax themselves for the benefit of a London charity; so they will probably put them on the "Index Expurgatorius" of stamp collectors, as is done with some speculative issues of South American and other countries. Such stamps are not viewed as stamps by collectors.

The American Society of Naturalists and the societies affiliated with it will meet on December 28, 29 and 30 at Ithaca, N. Y. The societies which meet with the American Society of Naturalists are: The Association of American Anatomists, the Association for Botanical Morphology and Physiology, the American Morphological Society, the American Physiological Society, the American Psychological Association, Section H (anthropology) of the American Association for the Advancement of Science.

We find, says Health, from a newspaper directory recently issued, that the medical profession of the United States supports, directly or indirectly, 275 periodicals, of which 10 are issued weekly, 11 fortnightly, 225 monthly, 6 bimonthly and 23 quarterly, with a combined yearly circulation of 16,017,200 copies. Estimating that there are in round numbers 120,000 medical men of all schools north of the Gulf of Mexico, of whom probably not over 80,000 subscribe to a medical journal of any kind, this vast amount of literature seems an enormous burden to carry.

The congress of German naturalists and physicists at Brunswick unanimously passed a resolution, introduced by Profs. Virchow and Waldeyer, to be forwarded to the Kaiser, begging him to consent to the equipment of a German South Sea scientific expedition to be supported by imperial funds. It is estimated to cost 300,000 marks. German scientific men are anxious that their country should take part in an expedition to the South Sea, where so much still remains to be done. It is known that the Kaiser is favorable to the idea, but it is doubted whether the Reichstag will grant the money.

THE Hudson Journal says the SCIENTIFIC AMERICAN should have a place in every dwelling, shop, office, school or library. Workmen, foremen, engineers, superintendents, directors, presidents, officials, merchants, farmers, teachers, lawyers, physicians, clergymen, people in every walk and profession in life, will derive satisfaction and benefit from becoming regular readers of the SCIENTIFIC AMERICAN. We concur fully in what our good contemporary prints.

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FIREPROOF STEEL AND BRICK GRAIN ELEVATOR.

(Continued from first page.)

is nothing more nor less than a brick vault with brick and steel ceiling.

The main grain floor is fireproof, underlined with tiling with convenient openings; so that, in place of its being necessary to sweep it in order to keep it clean, it can be flushed every night with water and drained into the canal alongside of the building. The upper floors, joists, rafters, girders, garners, scale bins and all other parts of the building other than the brick wall surrounding the structure are built of steel. The power necessary to run the machinery is transmitted to all the different elevator legs, conveyor belts, marine towers, and other necessary machinery, by electricity conveyed from Niagara Falls, twenty-three miles distant.

The building has a pile foundation, the piles being driven down from 30 to 48 feet below water to solid rock. Stone piers 8 feet high were laid on top of this foundation, supporting the columns. The elevator bins are built cylindrical in form, with a cone-shaped bottom, and consist of thirty bins 38 feet in diameter, 70 feet high; eighteen bins 15 feet 6 inches in diameter, 70 feet high; eighteen exterior small bins 9 feet 9 inches in diameter, 60 feet high; furnishing a combined bin capacity of 3,000,000 bushels. All the 38-foot and 15-foot 6-inch bins are built on a patent circular girder plan as suggested by President James J. Hill and patented by Mr. D. A. Robinson, the builder. The steel in the bins varies from ¼ inch to ½ inch in thickness and the total weight of metal in the bins is 6,000 tons.

The dock facing on Blackwell Canal is 24 feet wide, and is built of stone, with two standard gage railroad tracks, on which the movable marine towers rest. There are three marine towers constructed of steel throughout, each equipped with a marine leg, capable of elevating from vessels 20,000 bushels of grain per hour, and as each of these marine towers can be moved to connect with the hatches of a vessel, by means of a wire cable run by an electric motor, it is possible to unload 60,000 bushels of grain per hour from a ship. The grip for moving the marine towers is practically on the same principles as applied on cable lines. The machinery in each marine tower is driven by a 100 horse power motor. The main building is equipped with ten elevator legs, and each of these is driven by an independent 50-horsepower motor.

The cupola, which is built the whole length of the main building, is 40 feet wide, 400 feet long and 67 feet high. The top of the fourth story of the cupola is occupied by the elevator heads and gearing for reducing speed. The third story is occupied by 27 steel garners of 1,500 bushels capacity each. The second story is occupied by 10 (1,400 bushels capacity each) steel hopper scales. The first story on the top of the bins is equipped with ten of the Simpson & Robinson patent double-jointed distributing spouts for distributing the grain from the scales and various bins. There are also two of these spouts used for distributing the grain from the four cleaners to the various bins. There are two belt conveyors, 60 inches wide, on the spout floor, equipped with reversible motors and Robinson's patent reversible self-moving trippers. These are the largest conveyor belts in the world, and have a capacity of 40,000 bushels per hour each. Each one of the ten elevator legs in the main building is driven by an independent motor of 50 horse power, the power being transmitted from the motors of the geared countershaft at the elevator heads by Robinson's single leg rope drive.

There are four cleaners on the second floor of the cupola, driven by a countershaft from a 100 horse power motor, and on the same floor are two double fans, one for dust collecting purposes and the other for running the sweeper system in the top of the elevator. There is a 50-horsepower motor on the work or ground floor, which is used for running the cable to move the marine towers. It also runs a cable operated under the building and through the railroad yard, enabling the elevator company to do its own car-switching by electrical power. This same motor, also, runs the dust collector fan which is connected with all the elevator boots, as well as the double sweep-up fan, which runs the sweepers. There is a double system of dust collectors, upstairs and down, and a system of sweepers, each independent of the other. This method is entirely new and has never been used before.

The walls and roof of the steel cupola are covered with corrugated iron. There is an electric passenger elevator running from the work floor to the scale floor; and, also, a passenger elevator in each of the marine towers, which runs from the lower floor to the machinery and sheaves in the top of the towers; and in addition there are also spiral steel stairways in each marine tower, and two spiral steel stairways in each end of the elevator building. In addition to the motors above enumerated, the plant is equipped with a 10-horsepower portable motor on the portable shovel machine, which can be used for unloading cars or shoveling grain from the floor to the elevator boots, in case the basement of the elevator is filled with grain, at the close of navigation. A steel awning on one side of the building covers double tracks for loading cars, protecting grain so loaded from adverse weather conditions. There are nine shipping spouts that go between the cars, loading nine cars at a time on either track.

The three marine towers have an unloading capacity from boats of 600,000 bushels per day of ten hours, and the warehouse has a shipping capacity of 400 cars per day, as well as a shipping capacity of 100,000 bushels per day at the end of the elevator for canal boats, and a shipping capacity of 200,000 bushels at the side of the elevator on the Blackwell Canal.

The power is brought into the building on three wires, in the shape of a three-phase alternating current, at 2,200 volts. These wires are connected to a primary panel of white marble, which contains three plug switches and three high potential fuse blocks. From this primary panel leads are run to two 500-kilowatt transformers, which convert the current to two-phase at 420 volts. From these transformers four leads of 1,000,000 circular mils each are run to the distributing switchboard. This distributing switchboard is also built of white marble, and consists of nine separate panels, upon each of which are mounted starting and controlling devices for two of the motors. The starting devices consist of choke coils introduced between the 420-volt mains, for the purpose of cutting down the potential in order to reduce the first rush of current. The motors are operated by means of a double throw switch, one set of terminals being connected to the choke coils and the other set to the full potential. Upon starting, the switch brings the choke coils into circuit with the motor, and, when full speed is reached, the switch is thrown over to the full potential terminals. The motor equipment consists of eighteen two-phase induction motors with a capacity aggregating 1,000 horse power. These motors are of the brushless type, the wires being attached to binding posts mounted upon the frame of the machine. This insures absolutely sparkless running, as there are no sliding electrical contacts. All the motors are started and stopped from the switchboard with the exception of three motors in the moving towers, which have the switches and auto-starters mounted at the motors. This system of controlling all the motors which are located in the house from a central switchboard was adopted to prevent the ignition of the explosive grain dust likely to be caused by sparking.

The wiring from the switchboard to the motors was done on the three-wire system. All wires are run in the open and are supported on porcelain insulators attached to 2-inch by 6-inch wooden strips, which in turn are fastened to the brick walls and iron beams by means of lag screws and hook bolts. Wires throughout are kept uniformly a distance of seven inches apart. All wire was tested to a breakdown potential of 9,600 volts before being installed. The current is carried to the moving marine towers by a trolley system. The three trolley wires, which are of the figure 8 section, are fastened to and run the entire length of the dock side of the building, the current being taken from these wires by trolleys mounted upon the side of the towers. The height of the trolley wires is 40 feet above the dock. Owing to the large amount of current being carried, trolley shoes 6 inches long and grooved to fit a figure 8 trolley wire were used instead of wheels.

The building is lighted by incandescent lamps run on a two-phase system at a potential of 104 volts. The current for these lamps is supplied through two separate transformers, which are also located in the transformer room and whose primaries are connected directly with the 2,200-volt three-phase mains.

The transformer room is a solid brick vault with arch brick sills resting on steel girders. The construction of the building is such that it is absolutely proof against fire, and the protecting of grain stored therein by insurance is almost a sentimental safeguard. The structure has been so recognized by the Board of Underwriters in the making of the rate for this hazard so low that the cost of insurance is of but little moment.

Just six months from the time the building was started it was put in full operation; a remarkable fact, when the great size and novelty of the structure are taken into consideration.

Compressed Flour.

The British Admiralty and the War Department are testing, under various climatic conditions, the new method for preserving flour. One objection to the establishment of national granaries has been the difficulty of storing grain for any length of time. The grain germinates and is ruined, and to keep large quantities in sound condition has been pronounced impracticable. Experiments are being made with a system of compression into bricks by hydraulic pressure. The trials show that the flour so treated is not affected by damp, even under unfavorable conditions, and is free from mould. The compression destroys all forms of larval life and the flour is thus rendered safe from the attacks of the insects. The saving in storage is enormous, as the cubic space occupied by 100 pounds of loose flour will hold more than 300 pounds of the compressed article.

Correspondence.

Beet Sugar Industry in Nebraska.

To the Editor of the SCIENTIFIC AMERICAN:

In the continuation of your article on "The American Beet Sugar Industry," page 338, in No. 22 of the SCIENTIFIC AMERICAN, there is an assertion about Nebraska which I cannot allow to stand without correction, in the interest of the farmers and business men of this State. As an old practical European expert I have personally no interest whatsoever whether or not the group California-New Mexico or the group Nebraska-Utah is of greater promise as a sugar producing district. I am only interested so far that the beet sugar industry will prosper with the best results in the United States. You may classify me, therefore, to be entirely impartial and unbiased, although being accidentally a resident of Nebraska, and you will undoubtedly follow the maxim of equal rights to all, not wishing to inflict an injustice to the farmers and business men of Nebraska by possibly a one-sided presumption of your informant.

I wish to state that I had more than thirty years of practical experience in the line of beet sugar industry in Europe. Besides this, I have been for years a correspondent of the Viennese imperial meteorological central bureau, and as such I studied the weather observations in Europe carefully.

After this introduction, I request you to give space in your highly instructive and esteemed publication to the short correction; for it is not so much what your informant does say in conclusion of the article about the beet culture in Nebraska as what may be deduced therefrom between the lines by diligent reading capitalists or investors.

The American beet sugar industry is at present a topic of more than ordinary interest, for it means an important development of our rich agricultural resources to the lasting benefit of the whole country. In weighing the possibilities of different localities for beet culture, it is absolutely necessary to observe fairness and correctness in the assertions. If it is said in the said article on the subject, "to sum up, therefore, the future of the industry in California and New Mexico is quite rosy; in Nebraska and Utah it is somewhat problematical, though by no means dark," then it seems that the last inference is somewhat hasty, because there have been working with the best results beet sugar factories in Nebraska.

Comparisons between the European meteorological observations and those of the United States Weather Bureau for the Nebraska eastern and center sections (furnished by Mr. G. A. Loveland, section director) show that the normal annual precipitation, $25\frac{6}{10}$ inches the average for the last twenty years in east Nebraska,* has been decidedly about one inch more for beet culture in the two eastern sections and in the central section of the State than the normal annual precipitation in the principal beet districts of Germany and of the Bohemian and Moravian parts of Austria. The average annual temperature in these three sections of Nebraska ($48\frac{6}{10}°$) is about 4° to 5° Fah. higher, and therefore somewhat more unfavorable than in the German and Austrian beet districts, but this seems to be neutralized by the better soil and by the significant fact that in Nebraska (ill reputed for so-called deficiency in moisture) 67 per cent of the yearly precipitation has fallen, during the twenty years of official observations, in the period of vegetation, in the months from April to August inclusively. The maturing period of the beets extends very far into October. A better showing cannot be made by any European beet growing district, hardly as good a one by any one of them. The mistaken idea that Nebraska must be devoid of sufficient moisture for beet culture seems to be traceable to the exceptionally dry years 1893, 1894, and 1895, remembered by all the people in the United States as the years of the great drouth, and perhaps to the fact that the arid western part of the State has been taken as a criterion for the whole commonwealth.

The reports of the Weather Bureau are easily obtainable and ought to be made the basis of all such deliberations, for they are the only reliable source of information on subjects in regard to this new industry. A study of these reports bearing on the climatic conditions of the eastern half of Nebraska will convince every unbiased observer that these conditions are most favorable for the successful development of the beet sugar industry. Essential tests, quality and quantity, of beets grown in the State, in the existing sugar factories have proved this to be the case beyond any doubt or negation.

SARKANDER.

Omaha, Neb., December, 1897.

ZAANDAM, in Holland, has been celebrating the two hundredth anniversary of Peter the Great's stay in the town, where he worked as a ship carpenter. They had historic processions and boat races, and performed a play. "Peter Michaeloff," by a local playwright. The Czar sent a special envoy, and the Russian minister at the Hague was also present.

* Respectively northeast, southeast and central.

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NEW METHOD OF MANUFACTURING HEAVY ORDNANCE.

Many efforts have been made from time to time to produce a gun of the larger calibers which could be "knocked down" for convenience of transportation in the field and readily put together by the artillerymen wherever it was desired to use it. Some very successful guns of this type have been constructed for mountain service. A common form is that in which the two halves have a screwed connection at the trunnions; but no attempt has hitherto been made to subdivide the gun proper into more than two parts, and for this reason the building of "knock down" guns has been restricted to the medium calibers. The weight of the individual parts in large guns and the difficulty of making a satisfactory screwed connection in them have apparently discouraged the inventor from any attempt in this direction.

We have been favored by a correspondent with the accompanying illustrations of a system of "knock-down" construction which is intended to be applied to guns of any size and weight. Fig. 1 shows a view of the gun ready for firing, and Fig. 2 is a longitudinal section of the gun, from which it will be seen that it is built up in sections, each of which consists of rolled sheet-steel disks held between terminal crossheads by steel tie-rods. Longitudinal support is also afforded to the rear half of the gun by a number of internal tapered tie-rods which are drawn up by means of nuts at the breech. The rods are tapered in order to make it practical to knock that part of the gun down. After all the disks have been assembled and bolted up, they are bored centrally with a taper that fits the external diameter of the rifled steel liner or barrel, which is made in the usual manner, except that it is tapered and is lighter than the inner tube which is used as a nucleus upon which to build up heavy guns of the common type. The initial tension in the steel disks is secured by clamping a hydraulic jack to the breech crosshead and forcing the inner barrel into its tapering chamber. It is claimed that the enormous wedging effect due to the gradual taper of the tube, combined with the heavy pressure with which it is forced in, enables the desired initial tension to be secured in the body of the gun.

The loading sleeve slides within a tubular steel screw, which serves to press the breech block so firmly in its place as to make a gas seal between it and the end of the inner barrel, at the same time holding the latter firmly in position while firing. The bolt in the breech crosshead enters a groove in the breech-block and prevents undue motion either way. One advantage of this construction is that the breech block may be taken out and carried away, thus rendering the gun useless should it be captured by the enemy, without rendering it unfit for use if recaptured. It is claimed that this system of construction insures thorough inspection and high quality in the material throughout every part of the gun and therefore removes the risk of faults or flaws, which is always more or less present in the large forgings of which the jacketed gun is built. It also largely reduces the time which is necessary for the construction of large guns, both because of the small size of the parts and the distribution of the work among several shops, where at present it must be confined to a few.

A further advantage is that the inner barrel may be readily removed and another one substituted, if it should become powder-burned or if the rifling should be cut, so that the life of the gun is thus prolonged indefinitely. A large gun can be constructed for less cost per pound than a small gun, whereas in the present system price increases in geometrical proportion to the size of the gun. Moreover, because this system of construction permits the building of a much larger gun than it would be practicable to use on shipboard, the coast defender is placed at a great advantage over an attacking fleet. But, perhaps, the most valuable feature of this system of construction is the great size of gun which could be transported by an army to a country which was not supplied with railway communication. The system is the invention of Mr. Edwin J. Blood, of Chicago, and a gun is now under contract for construction for English parties which it is expected will be tested by the Ordnance Department of our government at the proving grounds, Indian Head, Md. It is to be understood that the sectional view, Fig. 2, is not drawn strictly to scale, and is merely intended to show the general method of construction.

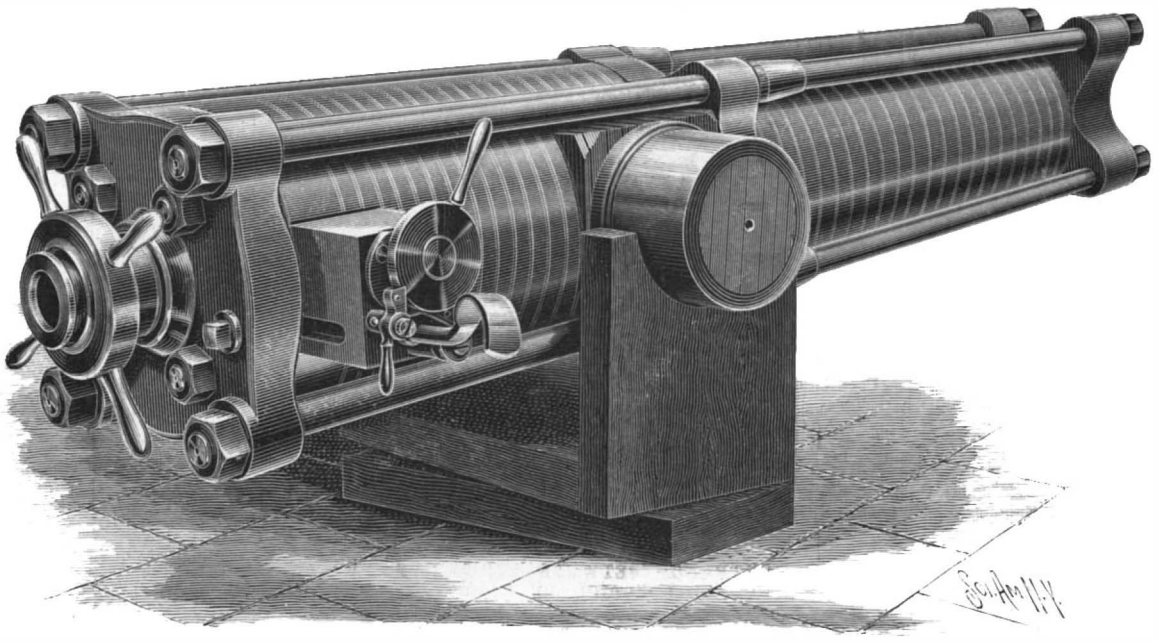


Fig. 1.—GUN CONSTRUCTED IN SECTIONS FOR READY TRANSPORTATION.

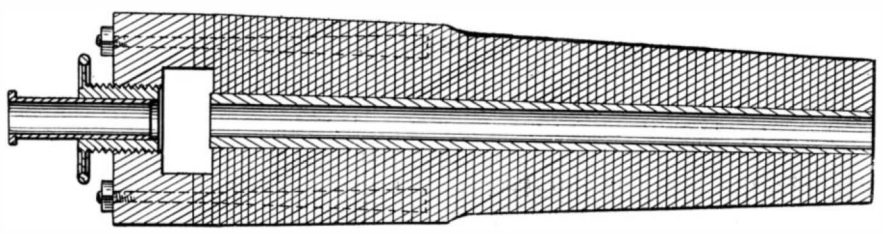


Fig. 2.—LONGITUDINAL SECTION THROUGH "KNOCK-DOWN" GUN.

The design is certainly novel, and if it does not develop transverse weakness, the gun may mark a step in advance in the art of heavy gun construction. It will be remembered, however, that the 110-ton guns of the English navy failed for want of transverse strength and showed a tendency to droop at the muzzle after a few rounds had been fired. This weakness was attributed to the fact that the rings of which the gun is built up did not possess sufficient length to impart stiffness to the chase of the gun. The defect was remedied by making the outer rings at the weak point about three times as long as they were before. In view of these facts it will be interesting to see how far the heavy tie-bolts of this new gun combined with the firmly driven in center tube will give the necessary transverse strength.

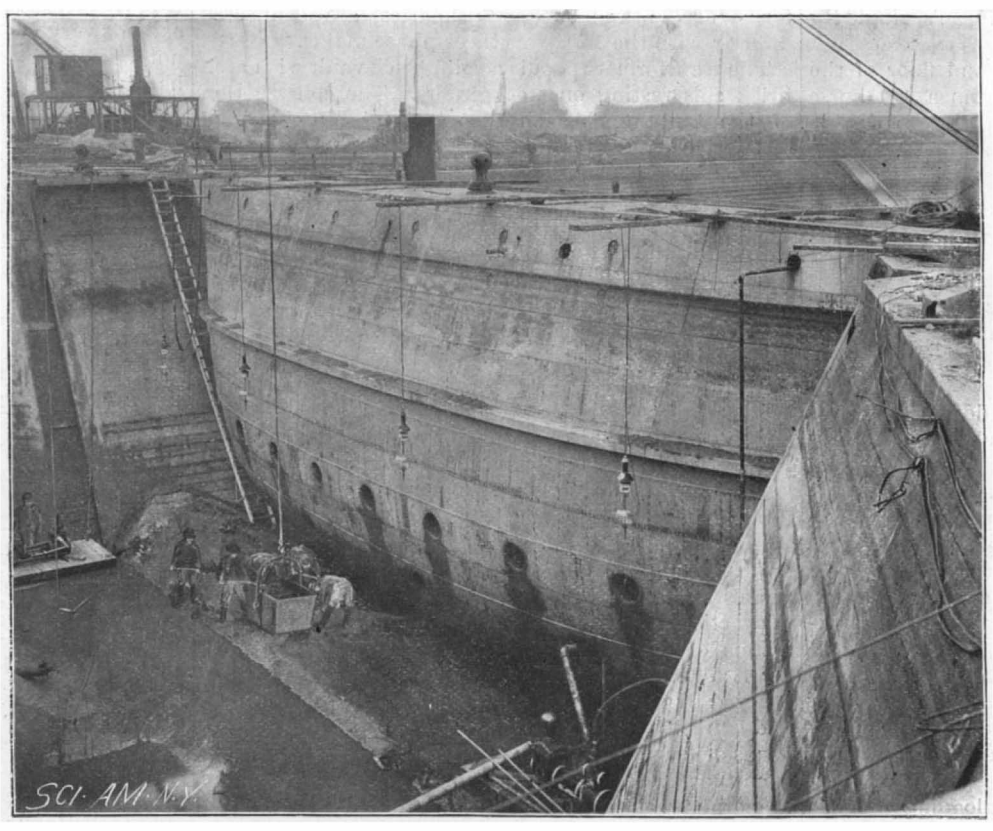
REPAIRING THE LEAK AT DRY DOCK NO. 3, BROOKLYN NAVY YARD.

The large wooden dry dock at the Brooklyn navy yard, officially known as No. 3, is just now the scene of a costly and difficult engineering work of a kind which has rarely been undertaken before. It will be remembered that this structure is the latest and largest wooden dock constructed in this country. It was built to accommodate the large battleships and cruisers which have recently been added to the navy, and it was more than anything else the necessity of having dry dock accommodation at the earliest possible moment which led to the dock being built of wood instead of the more lasting and reliable stone.

A detailed description of the dock was given in our issue of February 20 of this year, about the time of its opening. The length over all is 670 feet, breadth 151 feet, and the depth on sill 29 feet. The site consisted largely of made ground, and in preparing the designs special care was taken to prevent the seepage of water by providing several complete lines of sheet piling—continuous walls of heavy, square piles, which are tongued and grooved, and driven in close contact—which completely encircle the dock. There is one of these around the edge of the floor and another 26 feet back from the coping of the dock. They connect at the entrance of the dock with wing walls, of sheet piling, which are driven at right angles to the axis of the dock at each of the two sills and at the outer edge of the apron.

The new dock had not been many months in use before a serious leak developed, the water showing itself at the joints of the altar steps, near the caisson gate. It was at first supposed that water was making its way in by way of an old bulkhead which intersected the site of the dock on the north side. By sending a diver down on the outside of the caisson gate, however, and distributing coloring matter near the bed of the entrance channel, it was proved that the water was working its way in at that point, as the discoloration shortly appeared on the inside of the dock. This was rendered yet more probable by the discovery of a large hole which had been washed out just in front of the apron at the point marked A in the accompanying diagram, Fig. 3. The broken appearance of the sheet piling at the outer edge of the apron suggested that it had been accidentally torn up by the bucket of the dredge which had been used to cut out the channel from the river to the dock.

In order to examine the break and make the needed repairs it was necessary to build a huge cofferdam across the entrance channel and pump out the water. The magnitude of the task may be judged from the fact that the channel is 156 feet wide and the depth of the water is 34 feet, measured from mean high water mark. This gives a total hydrostatic pressure of 2,885 tons, which had to be withstood by the cofferdam. The construction of the dam is clearly shown in the accompanying photographs, and in the sectional diagram, for which we are indebted to Naval Constructor Bowles, of the Brooklyn navy yard. The dam consists of a central wall of clay puddle contained within three lines of sheet piling, backed up by two embankments of gravelly clay, the toe of the inner embankment being held by a fourth wall of sheet piling as shown. By reference to the large engraving, Fig. 4, it will be seen that the cofferdam is curved, presenting a convex face toward the river, or, to speak more strictly, it is built with five plane faces, those on the river side corresponding to the chords of a circle of 125 feet radius. This is done to secure an arch effect and cause the



1.—REMOVING MUD FROM APRON IN FRONT OF CAISSON GATE.

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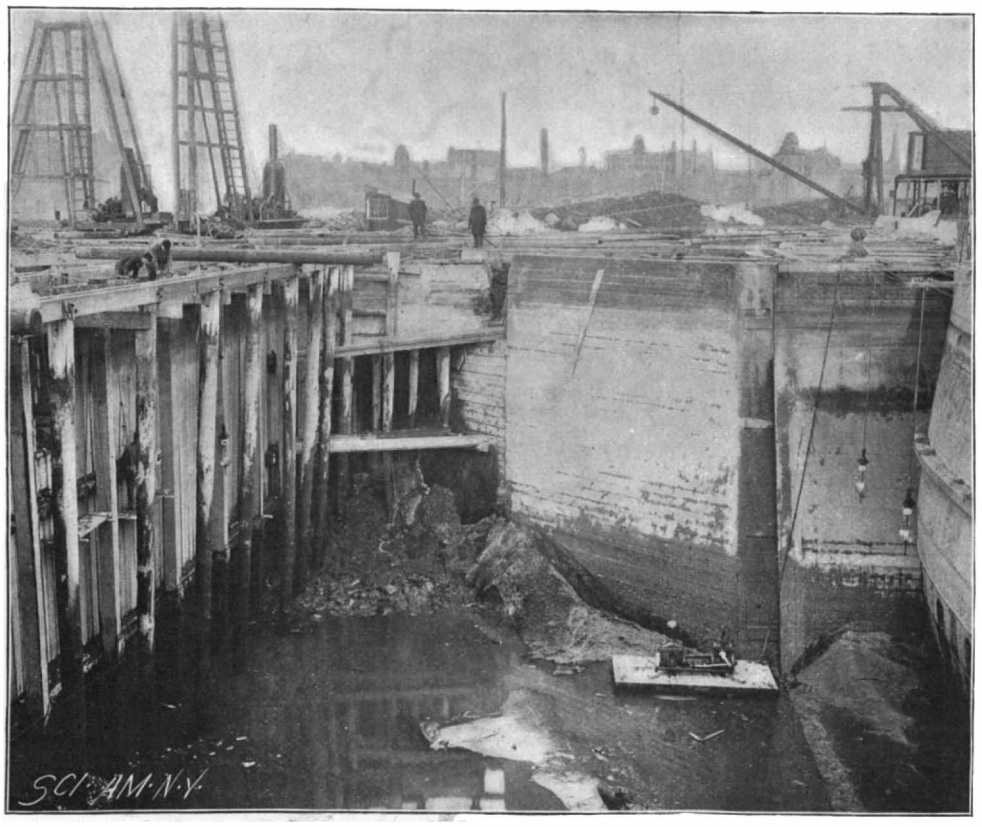
pressure of the water to be transferred to the walls of the channel, the latter acting as abutments. The lateral pressure thus set up is supposed to compress the lines of sheet piling and assist in keeping the joints watertight. Owing to the yielding nature of the sides of the channel, however, and the difficulty of driving the piles at the angles with a snug fit, it is a question whether a straight dam would not have been preferable. It would certainly have been cheaper, for it often took as long to fit and drive the angle piles as to drive the whole of one bent between them.

Soon after the commencement of operations, Naval Constructor Bowles was placed in absolute charge of the work, with instructions to push through the repairs with all possible speed. Contracts were at once let for the 600,000 feet of timber required; a temporary electric light plant was installed, and six pile drivers were put to work. Sticks of the size and quality required for the piling are not kept in stock, and when the contracts were let the 600,000 B. M. was yet standing in the Georgia pine forests. This had to be cut, dressed, hauled to a Southern port, and brought up to New York. Delays due to the non-delivery of the timber were frequent, and it was only by unflagging attention that the work has been brought to the present stage.

The first operation was to drive eight lines of 14 by 14-inch guide piles, in pairs. Then the guide wales (horizontal lines of timbers to keep the sheet piles in line) were bolted in place. As three of these lines on each set were under water, they had to be adjusted by divers. This was slow and laborious work. Where the guide piles were out of line, blocking had to be inserted or notches cut in the guide wales and the piles drawn up to the wales by U-shaped yokes and bolted. The sheet piling is 12 by 14 inches and tongued and grooved. It is driven 16 feet into the mud, and in the four walls there are 1,100 separate sticks 56 feet in length. The sheet piling was carried well into the banks of the channel, the concrete coping of the dock being blasted out for this purpose. The three walls of piling were then braced by a system of 1½-inch tie bolts and 12 by 12-inch braces, the latter being notched onto the guide wales and well spiked both to the wales and the guide piles. The structure was also braced at each end against the sides of the dock with heavy sticks of timber, S, S (Fig. 3), and ⅞-inch iron chains were carried back from the top of the cofferdam to the mooring-posts on the dock, and drawn taut by means of turnbuckles.



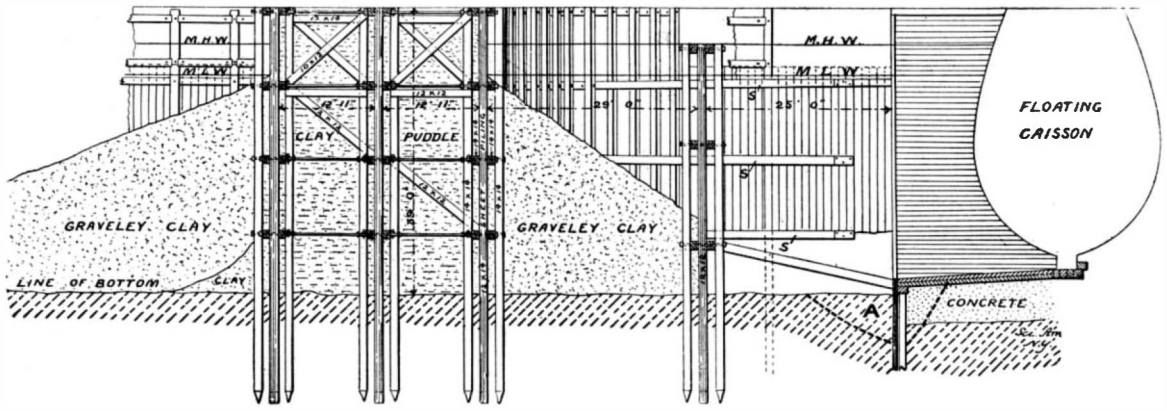
2.—BOTTOM OF DOCK ENTRANCE BETWEEN COFFERDAM AND CAISSON, SHOWING LOCATION OF LEAK.

The cheapest bid that could be obtained for supplying the material for filling the cofferdam was $1.75 per cubic yard, and 80 cents per yard was asked for digging up the clayey soil in the neighborhood of the dock. Finally a lump contract at 40 cents per yard was closed for supplying the 18,000 yards required by using the mud excavated for the adjoining Wallabout dock extension. This was brought round in scows and unloaded by dredges at the dam. This mud has answered admirably for the purpose and proved quite impervious to water. The saving in this direction has fairly well offset the costly delays due to the failure of contractors to supply the timber.

The dock was emptied by the regular dock pumps, and, as the water fell, the cofferdam proved to be a remarkably tight job, practically no water coming through. Our illustrations, Figs. 1 and 2, show the pumped out space between the dam and the caisson gate. The gate is resting on the inner sill, and the line of the outer sill can be traced by the drop in the level of the mud. About twenty feet beyond this is the edge of the apron, where the sheet piling was torn up by the dredge, as already explained. The water is seen standing in the holes which have been washed out around the vicinity of the leak. A day or two after our photographs were taken, the lowering of the water showed that the whole line of piling had been more or less battered up and torn away by the dredge bucket. It is little to be wondered at that the dock was leaking.

To make the dock thoroughly secure against further trouble, two lines of sheet piling will be driven, one in front of the damaged piling and another at the outer sill, on which the caisson gate is shown in the accompanying diagram. The new piles will be heavier—12 by 12 inch, in place of 8 by 12—and they will be 35 feet in length and driven as deep as they will go in the mud. The new piling will be driven up the slopes at the sides of the entrance, and carried out to a junction with the outside wall of piling which surrounds the entire dock. The present floor of the apron will be ripped up, the three or four feet of concrete which underlies it taken out and fresh concrete filled in to as great a depth as can be conveniently excavated. The flooring will then be relaid in two courses with broken joints, with its outer edge finished off in snug contact with the new line of piling.

The fact that no water is now entering the dock proves that the leak must all have taken place at the damaged apron; and it is safe to say that when the present repairs are completed, Naval Constructor Bowles will place a perfectly sound dock at the service of the navy yard.



3.—CROSS SECTION THROUGH COFFERDAM.

4.—COFFERDAM ACROSS ENTRANCE CHANNEL—DRY DOCK No. 3, BROOKLYN NAVY YARD.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM GENERATOR.—Henry C. Christopher, Meridian, Miss. In this generator the gaseous products of combustion are conducted from the furnace proper into the water space, to more fully utilize the heat and economize fuel. The combustion chamber is located in and entirely surrounded by water in a primary boiler, and the upper end of the combustion chamber is connected by a flue and valved pipe with a second boiler, into which the gases and products of combustion are discharged from a submerged outlet, the gaseous products of combustion being mingled with the steam in the second boiler, and used therewith in driving machinery, etc. The two boilers are so connected that an even pressure may be maintained in both, and steam may be taken from either or both of them as desired.

BOILER ATTACHMENT. — William I. Miller, Atchison, Kansas. To prevent freezing in the feed pipe of a boiler, more especially a locomotive boiler, this invention provides an attachment which allows a circulation of hot water through the pipe when the feed pump or injector is not working. The main or boiler check valve and the lower intermediate valve are each provided with a small passage to permit the leaking of hot water around and past the valves when the feed or injector is not in operation, the leak of the intermediate valve being always open, and the other subject to control, the feed pipe being thus always kept clear without affecting the ordinary operation of the feed.

GAGE COCK.—George Johnson, Allenport, Pa. According to this invention a casing secured to a boiler has at its inner end a valve seat, the valve being seated by pressure from the boiler, and the stem of the valve extending through the casing and a stuffing box, while a cam on the stem is adapted to engage a cam surface on a cam attached to the casing. The device is not liable to get out of order, as it is without springs or other breakable parts, and leakage is completely avoided, as the valve is held firmly to its seat by the boiler pressure, and is always ground in its seat on opening and closing.

Railway Appliances.

CAR VENTILATOR.—Andrew J. McArthur, Gainesville, Fla. For refrigerator cars, this invention provides a simple and strong ventilator which may be elevated in sections in either direction with relation to the hatchway, and may be swung wholly away from the hatchway. The invention comprises a hatchway having walls extended above the car roof, a frame hinged to the hatchway carrying a screen, while a cover in two sections is hinged to swing, one relatively to the other, there being means for removably securing the sections to the frame and holding either one of them in open position.

REFRIGERATOR DOOR.—The same inventor has likewise obtained a patent for a door more particularly adapted for cars and cold storage rooms, the door being so made that it may be easily opened, and when closed will form a practically airtight joint between the door and its casing. Arranged between the door and jamb is a packing, preferably of tubular rubber, the door having inner and outer walls forming an air chamber, which may be packed with charcoal, sawdust, etc.

CAR DOOR.—John M. Smith, Van Wert, Ohio. In freight car doors mounted to slide, this invention provides a simple and economic device, applicable to any sliding door, and designed to render the door storm proof, dust proof, and burglar proof. An angle iron lies against one side of the door frame, and is held capable of adjustment toward and from the door, a wing being pivoted to the angle iron and a latch holding the wing in connection with the door. The door does not bind at the bottom, and the locking and sealing devices are so mounted that the door may be as readily opened when the sides of the car are bulged or sprung outward by heavy loading as when the car is unloaded.

STREET TRAMWAY TRACK CLEANER.—Louis Lege, Hanover, Germany. An instrument adapted to run along the rail and scrape off accumulations therefrom has been devised by this inventor. It is attached by means of a post to the under side of the car floor, and has a receptacle adapted to receive material from the track the receptacle having rearwardly and outwardly extending branches to deliver the material at the sides of the track, and the cleaner having a tongue which runs in the groove of the rail.

Mechanical.

GRINDING MACHINE.—George W. Kirsten, West Orange, N. J. For grinding spherical or curved surfaces and twists of various kinds, this machine is arranged to properly support and adjust the work, and to hold the grinding wheel in the desired position, according to the shape to be given to the cutting edge. The machine has a carriage adapted to travel backward and forward, and holding an adjustable head with holder carrying a grinding wheel mounted to turn in the head, there being means for adjusting the holder laterally in the head. The operator is only required to adjust the work on the centers and adjust the grinding wheel vertically according to the edge desired.

MATTRESS TUFTING MACHINE.—Edward B. Dixon, Grantsborough, N. C. This invention covers an improvement in machines in which a series of pairs of needles are forced up through the mattress while held by suitable clamps on a suitable bed or frame. It is designed to enable the needles to be raised and forced up through a mattress with greater ease than heretofore; reduce the weight, number and cost of parts; provide lateral guides or holders for the mattress while on the frame, and make such guides vertically adjustable to accommodate mattresses of different thicknesses, while also providing a temporary holder for the tufts.

PUMPING POWER.—George W. Grimes, Bluffton, Ind. This invention provides a simple and powerful machine by which the pumps of several surrounding wells may be simultaneously operated, all the parts of the machine being conveniently assembled, and a large frame and supporting rods being dispensed with. Eccentrics and a power wheel are mounted to rotate on a tapered post, the lower end of the post engaging a socket in a base on which is an adjustable bearing plate having an annular channel, there being an upper bearing plate on which the hub of the power wheel rests.

Agricultural.

TREE PROTECTOR.—Charles C. Coulson, Riverside, Cal. This improvement embraces a series of frames connected by tracks on which canopies are adapted to slide, foot blocks resting on the ground supporting the frames, and stakes engaging the foot blocks, whereby the frames may be readily moved to a recumbent or upright position. It is designed more especially for use in climates liable to a frost on still and clear nights, as a protector also for large plants or vines, being quickly set up and taken down.

CLOD CUTTER.—Peter R. Campbell, Brierfield, Miss. This is a cultivating apparatus supported by runners, in which the clods are broken by knives or blades held to run along the ground. A knife frame is employed carrying longitudinal blades, and there are plowshares which throw the earth inward as the machine passes along the ground. The cutters have saw blades adapted to travel through the hardest clods with a minimum expenditure of power.

ROOSTING DEVICE FOR FOWLS.—Fred D. Dimcck, National City, Cal. For a poultry house or similar inclosure, this invention provides a device adapted to remove the droppings of the fowls and deposit them in a suitable receptacle outside the house. The roosting poles are arranged in a tier, and below them is a longitudinally adjustable endless apron, the apron being mounted on rollers and extending through an aperture in the inclosure. A scraper blade is mounted adjacent to the outside roller, by which the material on the apron may be removed.

FENCE —Bennett T. Hoshall, Shamburg, Md. This is a fence in which the rails, riders and stakes are bound together by wire locks, the rails of adjacent panels lapping at their ends against the post, and the wire ties passing over each of the rails near their extremities, thence under another rail and having a portion passed around the post. The several locks may be clamped to the post by nails or staples.

COW MILKING APPARATUS.—Modestus J. Cushman, Waterloo, Iowa. In this apparatus both suction and traction are simultaneously applied to the animal's teats, the main parts of the apparatus comprising an air pump, milk receptacles, a rigid milk conducting pipe extending horizontally the length of the cow stall in front of the stanchions, and a series of attachments or sets of teat cups connected by flexible branch tubes with the main conductor, there being means of applying traction to the branch tubes. An automatic vacuum apparatus and a water receptacle or holder are connected with the main milk conductor by branch tubes, A novel vacuum regulator is provided, and also means of readily adjusting the degree of traction to be employed.

Miscellaneous.

RECEIVER FOR GASES OR LIQUIDS.—Rudolf Kelting, Eschweiler 2, Prussia, Germany. In order that large receivers may be made of sheet metal, this inventor provides the receivers around their base with an exterior shell forming a space adapted to receive a filling, such as water, which will partly counterbalance the outward pressure of the contents of the receiver. Such receivers, when used as water tanks, etc., when made of extra large size or height, have had to be made of or strengthened with concrete or brickwork, a necessity which the improved construction provided for by the patent is designed to obviate.

PROCESS OF MAKING NITRITES.—August Knop, Rheinau, Germany. For the manufacture of alkali nitrites, this inventor subjects to the action of heat a mixture of a nitrate of the same alkali, the caustic alkali of the same element, and carbon, according to a specially devised process designed to afford great economical advantages, the process rendering possible the use of carbon in its cheapest form by adding a certain quantity of caustic alkali to the molten nitrate. It is claimed that it is possible to produce in the same time nearly twice as much nitrite as can be made by the lead process, with a corresponding economy of fuel and wages, the amount of coke consumed being insignificant.

IRONING TABLE.—William R. and Edward N. Murray, Parramatta, New South Wales. This is a table adapted for use as an ordinary kitchen table, and readily convertible into an ironing board. It has four legs rigidly joined at the top and bottom by rails, the lower rails supporting a leaf and the upper ones carrying a ledge forming part of the top of the table. The removable top of an ordinary kitchen table is supported by cleats, and a leaf adapted to be used as an ironing board may be readily placed in position, either leaf when not in use being held out of the way.

CLEANING WATER HEATERS.—George J. Dehn, Iron Mountain, Mich. To prevent the accumulation of lime or similar matter in boilers, water back or front ranges and connecting pipes, this invention provides simple means for automatically supplying a compound to the water to prevent lime, etc., from adhering to the interior surfaces. On a length of pipe designed for connection with the feed pipe is a vessel in which the compound is placed, the cover of the vessel being removed for that purpose and afterward secured in position, when, on opening valves arranged for the purpose, the compound is fed in through the feed pipe.

HEARSE. — James Burns, Cincinnati, O. This hearse is provided with a table for carrying a casket, and that slides forward and backward, admitting of very readily placing the casket in the hearse or removing it therefrom. By the adjustment of brackets the table may be held in any desired position, or it may be taken out entirely for cleaning purposes. The table may also be lowered so that the pall bearers may with greater convenience, place the casket on the table.

FIRE EXTINGUISHING APPARATUS.—Joseph O. Banning, New York City To facilitate handling and operating storage cylinders for fire extinguishing solutions, this inventor has devised a pump which will not siphon and whose handle may be locked when not in use, the pump having ball valves of metal to secure more perfect continuity of ejecting power, while the cylinder cover is provided with a removable liquid-tight cap which may be quickly adjusted or detached.

CIGAR OR CIGARETTE HOLDER.—George B. Schmidt, New York City. This device comprises a base portion provided with a pin, and from which extends a wire bent upon itself at its outer end to form an open loop or socket adapted to receive the end of a cigar or cigarette. The cigar, cigarette, cigar holder or pipe, carried by the device, may be brought to the mouth and held in proper position for smoking, leaving both hands of the smoker free. The device may also be used for holding a pen, pencil, etc.

STIRRUP.—William H. Wilson, Nocona, Texas. To so construct a stirrup as to prevent its strap bar from hurting the instep of the user and wearing his trousers is the object of this invention, the strap bar being offset with respect to the tread bar and rigidly connected therewith, the strap bar being relatively in advance of the tread bar and held from binding against the leg or instep when the boot is inserted to cause the heel to bear against the tread bar. There is no danger of the foot being caught in the stirrup in the event of the rider being thrown.

VEHICLE WHEEL.—Philip J. Parker, Brooklyn, N. Y. The tire of this wheel is formed of a series of tubular sections with closed ends, there being an air tube within the inner periphery of the rim from which posts lead into the tire, while valves in the sections of the tire are provided with tubes projecting into the openings of the air tube. By this means a puncture may be quickly located, and each section of the tire may be independently inflated or all or any of the sections may be inflated together. The invention is designed for bicycles, or for sulkies, road wagons and other vehicles.

BUCKLE.—Chrystie F. Nicholson, New York City. This invention relates principally to buckles for belts, and provides a buckle that is cheap to manufacture while it is also light and strong. The buckle blank consists of a single piece of sheet metal, which comprises the loop portion, short integral tongue, rear transverse bar and tang, etc.

Designs.

PLAYING CARD.—Michael F. Carey, Albany, N. Y. The leading feature of this design consists in diagonal lines extending over the face of the card and dividing it into fields of an approximately triangular shape.

GUARD FOR KEYS.—Thomas M. Hilliard, New York City. This design relates to a sheath or guard for a bunch of keys to prevent keys worn on the person from marring furniture, etc., the sheath being approximately bell-shape, and its upper end being adapted for connection with a belt to be worn around the person.

PLOW STOCK. — John W. Barnard, Shannon, N. C. This stock has an upright section terminating at its upper end in a fork, and a lower horizontal section representing a landside, with a shoe at its outer free end, there being in the side surface of the horizontal section a longitudinal depression.

TOE CLIP.—David Basch, New York City. This design relates to toe clips for bicycle pedals, and comprises rear lips continuous with the base, the base, toe guard and side guards being otherwise of the usual shape, while a pendent member extends downward from the rear end of the base.

BELT.—William H. Carr and John G. Wolf, New York City. This design relates to inside belts to be worn between the waistband of the skirt and the corset cover or corset, and the central back portion of the belt is slightly projected outward and has an angular slot adapted to receive and engage with a button.

TACKLE BLOCK —Thomas R. Ferrall, Somerville, Mass. The leading feature of this design consists in the cheek pieces of the block, which are elliptical in contour and have ends extending substantially to a point, the cheek pieces having circular ornamentation.

LEMON SQUEEZER.—George R. Blake, Winchester, Va. This design is for a squeezer adapted to rest upon a glass, the base portion having centrally grouped segmental openings, and there being an upwardly extending central cone in which are vertical corrugations.

COVERED DISH.—Robert L. Johnson, Hanley, England. This is a shallow outwardly flaring dish, the shape of the cover conforming to the upper portion of the body, with curved horizontal handles at the ends of the body, all appropriately ornamented.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

THE STANDARD MANUAL OF SODA AND OTHER BEVERAGES. A treatise especially adapted to the requirements of druggists and confectioners. By Emil Hiss, Ph.G. Over fifteen hundred formulas. Chicago: G. P. Engelhard & Company. 1897. Pp. 242. 8vo. Price $4.

What has long been needed is a thoroughly practical book of formulas for soda and other beverages. There have been a few books published on this subject, but in the main they are impracticable, largely because their compilers were neither chemists nor practical manufacturers of soda water. The present work is prepared on a proper plan. Special contributors furnished formulas and they have been edited by a competent chemist. The result is highly satisfactory. There are nearly fifteen hundred formulas, including the very latest flavors of beverages. The soda water business can be greatly extended by careful attention to details and it gives a handsome return to the pharmacist for his trouble.

A HANDBOOK FOR CHEMISTS OF BEET SUGAR HOUSES AND SEED CULTURE FARMS. Containing selected methods of analysis, sugar house control, reference tables, etc. By Guilford L. Spencer. First edition. First thousand. New York: John Wiley & Sons. London: Chapman & Hall. 1897. Pp. 475. Price $3.

The beet sugar industry promises to be very important in the United States, and the literature in English upon the subject, which was deficient a few months ago, is now being increased by several admirable works, of which the present is not the least. The author is connected with the Department of Agriculture Washington, D. C., and is well acquainted with the subject. We feel sure an examination of this work would be of value, not only to the sugar chemist, but to the general chemist as well.

MANUAL OF ASSAYING GOLD, SILVER, LEAD, COPPER. By Walter Lee Brown. Seventh edition. Chicago: E. H. Sargent & Company. 1897. Pp. 533. Price $2.50.

This is a valuable book and is strictly up to date, and those who are thinking of going to the gold fields of the Klondike or elsewhere should not fail to possess a copy of this work. It is impossible in the limits of an ordinary notice to describe the methods which are adopted, but it is safe to say that no more valuable work exists upon the subject. The book is pocket size and is handsomely printed.

SLEEP: Its Physiology, Pathology, Hygiene, and Psychology. By Marie de Manacéine (St. Petersburg). Illustrated. London: Walter Scott, Limited. New York: Charles Scribner's Sons. 1897. Pp. 341. Price $1.25.

This is a most interesting work, treating of the physiology, pathology, hygiene and psychology of sleep. It is published in Russian and in English. It is curious to see what an interesting book can be made upon the subject of sleep. One-third of our lives is passed in sleep, and it is fitting that we should know something at least of the hygiene of sleep, if not of its psychology. The bibliographies which are scattered through the work are very full and will prove of great value.

FESTSCHRIFT ZUR 38. Hauptversammlung des Vereins Deutscher Ingenieure, Cassel. 1897. Pp. 176.

This book deals with the various points of interest in the town of Cassel and the neighborhood and gives an account of the notable buildings and industrial establishments.

GOLD AND SILVER CURRENCY. In the light of experience, historical, economical and practical. A series of papers written for the Travelers' Record. Hartford, Conn.: The Case, Lockwood & Brainard Company. 1896. Pp. 70.

This is a series of papers written for the 'Travelers' Record by Mr. James T. Batterson, president of the Travelers' Insurance Company of Hartford, Conn., whose large experience in matters of finance specially fits him for the task of writing on gold and silver as currency.

IOWA GEOLOGICAL SURVEY. Vol. VII. Annual report, 1896, with accompanying papers. Samuel Calvin, State Geologist; A. G. Leonard, Assistant State Geologist. Des Moines. 1897. Pp. 555. 4to.

LITTLE MASTERPIECES: POE, IRVING, HAWTHORNE. Edited by Bliss Perry. New York: Doubleday & McClure Company. Cloth, 30 cents; full leather, 60 cents.

This series, each volume of which includes a discriminating selection of the characteristic short pieces of well known authors, is most daintily got up, the authorized text being used in all cases, with a short introduction by the editor. The volumes are small enough to be conveniently carried about in one's pocket, to contribute to the enjoyment of a leisure hour wherever one may happen to be—an enjoyment which is enhanced by the fact that their printing and style are in such excellent taste. Each volume contains a beautiful picture of the author from whose works the selections are made.

EASY LESSONS IN MECHANICAL DRAWING AND MACHINE DESIGN. By J. G. A. Meyer. Quarto, in 24 parts. Price 50 cents each.

The eighth number of this valuable work and reference for the draughting room, as well as a self instructing guide to the student and amateur, has just been issued.

POPULAR SCIENTIFIC LECTURES. By Ernst Mach. Translated by Thomas J. McCormack. Second edition. Revised and enlarged. Chicago: The Open Court Publishing Company. London: Kegan Paul, Trench, Truebner & Company. 1897. Pp. 382. Price $1.

Prof. Mach has an international reputation as a professor of physics. He is now professor of the history and theory of inductive science in the University of Vienna. The subjects of his lectures are as follows: The Forms of Liquids; The Fibers of Corti; On the Causes of Harmony; The Velocity of Light; Why Has Man Two Eyes? On Symmetry; On the Fundamental Concepts of Electrostatics; On the Principle of the Conservation of Energy; On the Economical Nature of Physical Inquiry; On Transformation and Adaptation in Scientific

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Thought; On the Principle of Comparison in Physics; On the Part Played by Accident in Invention and Discovery; On Sensations of Orientation; On Instruction in the Classics and the Mathematico-Physical Sciences. Appendixes. I. A Contribution to the History of Acoustics. II. Remarks on the Theory of Spatial Vision.

PHOTOGRAMS FOR 1897. London: Dawbarn & Ward, Limited. 1897. Pp. 114. 8vo. Price 80 cents in cloth; 40 cents in paper.

This is a pictorial and literary record of the best photographic work of the year, compiled by the editors of the staff of The Photogram, assisted by Gleeson White. This publication is supposed to represent the pictorial side of photography in various parts of the world. In this respect, since it began and the subsequent years have proved it to be uniformly successful, especially from an artistic point of view. This excellence is fully maintained in the present volume for 1898. We note several of the landscapes and views on the river during foggy days, in which the English amateurs excel. Possibly the most striking photograph in the whole work is drawing the charge from the retort in the gas works. This would make an ideal subject for a realistic painter. In addition to examples of artistic photographs are to be found others showing the progress in Roentgen photography and the kinetograph, among the latter being a page or more of minute pictures representing the crowd of photographers leaving the convention hall at Yarmouth last summer. These are so distinct that noted personages may be readily picked out. It is a book whose annual appearance is always appreciated and is one of the best printed annuals that comes from London.

SIXTEENTH ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL SURVEY TO THE SECRETARY OF THE INTERIOR. 1894–95. Charles D. Walcott, Director. Washington. 1896. 4to. Pp. 910.

The present volume contains the Director's Report and papers of a theoretic nature. It details the remarkable work which has been accomplished by this important bureau of the government. After examining this splendid volume, it is easy to see why the publications of the United States government are so much thought of abroad. Many of the articles in the report are of course only interesting to specialists, but anyone who is interested in science can easily spend an hour in examining it. The engravings adequately illustrate the work. There are 117 plates and 169 engravings in the text, besides valuable geological maps.

THE ARCHITECTS' DIRECTORY FOR 1897–98. Containing a List of the Architects in the United States and Canada. Together with a Classified Index of Prominent Dealers and Manufacturers of Building Material and Appliances. New York: W. T. Comstock. 1897. Fourth annual edition. Pp. 112. Price $1.

This excellent little book contains a classified list of the architects of the United States and Canada, and as it is issued by the publishers of Architecture and Building, it certainly should be trustworthy.

THE DWELLING HOUSE. By George Vivian Poore, M.D., F.R.C.P. London: Longmans, Green & Company. Pp. 178. $1.25.

The proper sanitation of dwelling houses is a leading subject in this handbook, a great portion of whose contents has been previously published in papers delivered before the Royal Institution, the British Medical Association, etc. Its illustrations and comments relate almost exclusively to the ideas and practice of English builders.

APPLIED MECHANICS. A Student's Treatise in Mechanical and Electrical Engineering. By John Perry, M.E., D Sc., F.R.S. London: Cassell & Company, Limited. Pp. 678. Price $3.50.

For students who have time to work experimental, numerical and graphical exercises, and who would like to review an entire course of instruction in applied mechanics, this volume presents the ready means, as it embraces a two years' course of such lectures at the Finsbury (London) Technical College. All mechanical and electrical engineering students in their first year have two lectures a week, and the substance of these lectures is here printed in large type, while the mechanical engineers had three lectures a week in their second year, and these are printed in small type, the whole forming a volume containing a great amount of technical instruction, chemical and building students also attending in the mechanical department. The Appendix contains many useful tables.

A NEW ILLUMINATED EDITION OF THE HOLY BIBLE, brought out by the American Bible Union, 230–238 South Eighth Street, Philadelphia (copyrighted by Frank E. Wright), presents a wealth of illustration such as, we believe, has never before been attempted in a volume designed for general circulation, and offered at popular prices. The text conforms to that of the Oxford Bible, of the University Press, Oxford, with full marginal references and a Concordance. The work is embellished with 800 pictures, designed not only to give the Bible student all possible assistance to the proper understanding of the Sacred Word, but to be faithfully and artistically illustrative of the text, as it has been interpreted at various times in the long period during which the Bible has been looked upon as the first of all books. The pictures also cover oriental scenes of many types and all ages of the world, including representations of recently discovered ancient monuments, with their almost undecipherable hieroglyphics, and fragments of papyri manuscripts which are now the objects of study by the most learned scholars. The typography and mechanical execution leave nothing to be desired, the type being large, clear and delightful to the eye, while all of the several types of binding in which the work is offered to the public, from the silk cloth to the full turkey, are of the same high character, as befits an edition de luxe.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7278) X. asks: Will you please give me through your column of Notes and Queries a receipt for making a hectograph composition and also a hectographic ink? I would like something better than the plain glue and glycerine composition, and also for an ink that would not rub and smear. A. Formulas for pads, also inks, are given in SUPPLEMENT, Nos. 1071, 1092, 1110 and 1119; price 10 cents each by mail.

(7279) W. R. asks (1) how a drum armature can be wound so that it can be connected to a two segment commutator. A. Connect the coils on one side in series end to end; also on the other side, and join the ends to the two part commutator; but there is no advantage in doing it. 2. What is the claim made for the drum armature over the shuttle? A. With a drum armature as many impulses of current flow into the line for each revolution as there are coils, and the current is rendered even and uniform. With a shuttle armature there is a decided fluctuation of current at the same speed, since there is but one coil. This is not a claim, but a fact. 3. What is the size and sustaining power of the smallest electromagnet ever made? A. We have not at hand the accounts of small magnets. You can find accounts of very small electromagnets which sustained very large weights in "Lectures on Electricity," by Prof. George Forbes, price $1.50 at this office. 4. In the SUPPLEMENTS describing the simplified Holtz machine, can the curved rod, G, forming the bearing for the sleeve, C, be placed in front of the revolving disk, or must it form the bearing for the sleeve? A. Make either arrangement, only let there be a firm support for the revolving parts. 5. Does it make any difference if the revolving plate is back instead of in front of the stationary? A. The side on which the discharge balls are is the front. It is much more convenient that the revolving plate should be on this side. There is also much less leakage. 6. Can a sal ammoniac battery be made with copper and zinc for the elements? A. Yes; but a very poor one, too poor for service. It gives less than one volt.

(7280) W. J. W. asks: Please inform me through your valuable paper how to resilver a looking glass? A. Valuable articles on this subject are contained in our SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 105, 121, 895 and 1006: price 10 cents each by mail.

(7281) F. H. M. writes: I wish to enlarge dynamo of which you give plans in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, to twice the dimensions given in paper. Would you kindly answer the following questions through the columns of your valued paper the SCIENTIFIC AMERICAN? 1. Should I use 48 divisions on commutators, or 24? A. The number of coils on the armature should not be changed. Wind 24 coils as before. 2. If 48 divisions are used on commutator cylinder, would it be necessary to use same number of divisions on armature core? A. Yes. 3. By doubling dimensions of dynamo gives it four times its capacity; using 14 wire on armature, 12 wire on field, would it run 32 16 candle power lamps more or less? A. Yes. 4. Could not the top of field, be cast in one piece instead of two, and bolts run down through field waists connecting all the field firm? If so, what size bolts, diameter? A. The principle of construction is to have as few joints in the castings as possible, as every joint causes some leakage. The top may be in one piece, and bolted as you suggest; ¾ inch bolts may be used.

(7282) F. S. G. writes: I have three Crowfoot gravity batteries on a short telegraph line; to charge them I put in 8 ounces of blue vitriol in each and filled them up with water, then to start the action I added 2 ounces of sulphate of zinc. I short circuited them, but the blue line will not come up any higher than the middle of the copper. What is the matter, and how can I remedy it? The way they are now, the three of them will not work one sounder. A. Fill the copper sulphate crystals in till the copper is covered. Then fill the jar with water till the zinc is covered. Short circuit for a few hours till the solution is clear like water to a point below the zinc. Your trouble is that you have not used blue vitriol enough. It is not necessary to use any sulphate of zinc in starting the gravity battery. It will form quite soon enough and will then have to be got rid of.

(7283) A. M. asks what the different compositions in the carbon for the brushes and arc lights are cemented together with. Would silicate answer the purpose? A. We are not able to give formulas as used by the different manufacturers of carbons; but the ground carbon powder is usually mixed with a sirup of sugar and gum and shaped by pressure. They are then baked in an oven to carbonize the adhesive substances. The details of the process are considered trade secrets. The Carre carbons are said to contain of powdered coke 15 parts, calcined lampblack 5 parts, special sirup 7 to 8 parts, mixed with water, moulded and dried in a crucible.

(7284) J. C. P. writes: I have a dynamo giving a current at terminals of 60 volts, 16 amperes. I wish to light a small Foucault arc lamp carrying ¼ inch carbons. 1. What resistance should I introduce in series with the same, dynamo running shunt, to get the most satisfactory results, i. e., quiet arc? A. The voltage and current taken by an arc lamp vary with the length of the arc, when properly lighted. Measurements with ¼ inch carbons gave these results:

Amperes.	Volts.
9·	35
8·5	40
6·5	50

Assuming your smallest drop then in the arc to be 35 volts, you will need to provide for 25 volts and 9 amperes in the resistance box. Apply Ohm's law to this: $C=\frac{E}{R}$; or $R=\frac{E}{C}=\frac{25}{9}=3$ ohms. The lamp has the other 4 ohms which are needed to pass 9 amperes. $R=\frac{35}{9}=4$ ohms nearly. The resistance box should allow of varying the resistance from the smallest to the largest current required in your work. 2. Carbons seem to tend to burn to a slim pencil point. Why? A. Your lamp gets too much current. 3. In my 90° arc lamp, taking current of 40 volts and 12 amperes with cone carbons, a horn grows out on negative carbon and tends to short-circuit the arc. Why is this? How can it be avoided? A. By giving the lamp more resistance in box, and so less current.

(7285) M. L. F. asks for the best receipt for a powder or dry mixture fire extinguisher—something to throw into the fire that will put it out, and that will keep a long time without losing its strength. A. Vienna Fire Extinguishing Agent: A solution of 5 parts ferrous sulphate (copperas), 20 parts ammonium sulphate, 125 parts water. Johnstone's: Make a mixture of equal parts of pyrolusite (manganese dioxide), potassium chlorate, potassium nitrate. Moisten with water glass and press into a block. Place the block in a pasteboard box. Several boxes, connected by fuses, are suspended from the ceiling of a room.

(7286) W. J. A. says: A few evenings ago, a friend of mine took out of his pocket a box containing long white "pills," tapered at each end. Laying one of these on the edge of a table, he applied a match and lit the end of it. Burning slowly, the "pill" transformed itself into gray material about 5 inches long. This gray matter seemed to writhe like the body of a snake while forming. After the "pill" stopped burning, their formation would fall in pieces if touched. Can you give me a receipt for making them? A. Pharaoh's serpents are made as follows: One grain of dry mercury sulphocyanide is mixed with some gum tragacanth which has previously been soaked in hot water. When the gum is completely softened, it is transferred to a mortar and the mercury sulphocyanide (in fine powder) is mixed with it by aid of a little water, so as to turn out a somewhat dry pill mass. This is then formed and cut into pellets of the desired size, which are dried on glass. These are very poisonous, and must be handled with care. Do not inhale the fumes.

(7287) G. S. M. asks: Can aluminum be used in castings for a gasoline engine of 1 horse power? If not, why? Could I save any weight by using brass or gun metal instead of iron? A. Pure aluminum can be used in many of the parts of a 1 horse power gasoline engine. If lightness is the principal object: An alloy of 90 parts of aluminum, 9 parts of silver, 1 part of copper—all by weight—makes a very hard but workable metal, suitable for cylinder, piston and valves. The specific gravity of this alloy is but very little more than pure aluminum. The cylinder could be covered with a thin sheet metal water jacket, and thus make a very light and beautiful engine. This alloy makes close grained castings and can be easily soldered.

(7288) W. M. Z. asks: 1. How fast will air travel through a pipe leading into a vacuum? A. The theoretical velocity with which air will flow into a vacuum if wholly unobstructed, is 1,347 feet per second. The coefficient for an orifice is 0·707, which limits the quantity value to 952 feet per second. The friction of the air in the pipe still further retards the flow according to its length. 2. How much in bulk will air compress under different pressures? A. There is no known limit to the compression of air at ordinary temperatures; 15,000 pounds per square inch has been attained without liquefaction. At a temperature of 220° below zero, Fah., it liquefies at 573 pounds pressure per square inch. 3. How long will it take an air pump, say 10 horse power, to create a vacuum in a vessel of 1,000 cubic feet? A. A perfect vacuum cannot be made by any ordinary vacuum pump. The time of obtainining an approximate vacuum depends upon the relative volume of the pump and vessel, as also the speed of the pump; an approximate time, barring leakage, may be found by subtracting the pump volume from the volume remaining in the vessel for each stroke of the pump.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

DECEMBER 14, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adding machine, G. L. Ault 595,592
Advertising apparatus, J. H. Hollen 595,541
Air controlling device, A. Roesch 595,654
Alarm. See Bicycle alarm.
Alarm device, electric, F. Louis 595,398
Album, W. Bruns 595,467
Animal trap, S. W. Buck 595,601
Annealing iron castings, R. King 595,393
Annealing pot, M. J. O'Meara 595,494
Armature cores, space block for, A. F. Batchelder 595,364
Axle, vehicle, A. C. G. Dupuis 595,469
Badge, S. Thomas 595,663
Bale tie, T. C. Edmonston 595,534
Barrel head, A. N. Clark 595,371
Barrel machine, L. M. Greif 595,565
Basin trap fixture, wash, C. H. Moore 595,577
Basket holder, berry, N. R. Miller 595,642
Battery. See Secondary battery.
Bean picking machine, E. H. & F. A. Cherry 595,523
Bearing, roller, W. L. Miller 595,328
Bed, invalid's, S. C. Attkisson 595,514
Bell, pneumatic door, J. Hunt 595,630
Bench. See Draw bench.
Bicycle alarm, G. J. Paehtz 595,334
Bicycle crank, J. E. Edwards 595,535
Bicycle cranks and sprocket wheels with shafts, means for connecting, F. C. Avery 595,515
Bicycle driving gear, J. E. Stoops 595,501
Bicycle driving mechanism, A. Pappardakes 595,579
Bicycle driving mechanism, W. D. Smith 595,661
Bicycle frame, A. H. Pettit 595,459
Bicycle lock and support, I. S. Covell 595,605
Bicycle luggage carrier, H. J. M. Baker 595,517
Bicycle pedal attachment, J. W. Hanson 595,388
Bicycle propelling mechanism, H. Schafer 595,460
Bicycle saddle, J. H. H. Burge 595,434
Bicycle saddle, J. A. Lamplugh 595,599
Bicycle seat, C. M. Richmond 595,680
Bicycle valve, M. A. Morris 595,578
Blind raised or lowered by means of electricity and solar rays, E. Roth 595,343
Boiler. See Range boiler. Steam boiler.
Boiler furnace, A. Rahner 595,339
Boiler furnace, steam, C. T. Rogers 595,341
Boiler furnace, steam, Young & Lewis 595,666
Boiler water indicator and alarm, steam, L. Steigert 595,418
Bolt. See Cycle safety bolt.
Bolt, W. Murphy 595,331
Boot and shoe shining machine, W. Rinker 595,581
Boring machine for dowel doors, E. B. Hayes 595,568
Bottle, D. R. Saunders 595,499
Bottle, non-refillable, C. A. Dunbar 595,612
Bottle, non-refillable, J. R. Latham 595,487
Bottle, non-refillable, W. T. Strasser 595,447
Bottle, nursing, J. C. Roach 595,414
Boutonniere, badge, etc., C. Rosin 595,655
Box. See Coin box. Condiment box. Mail box. Paper box.
Bracket. See Curtain rod bracket. Shade bracket.
Brake. See Horse power machine brake. Railway brake. Wagon brake.
Brake shoe, A. L. Streeter 595,588
Bread knife, G. H. Blanchard 595,597
Burial casket, O. D. Byers 595,602
Burial casket, W. S. Jones 595,632
Burner. See Gas burner.
Button, E. Candel 595,286
Cable grip, J. S. Peden 595,495
Calculating machine, J. Byrne 595,603
Calculating machine, A. Schabadt 595,347
Camera, kinetographic, P. Gautier 595,620
Camera, magazine, J. L. Atwater 595,591
Camera, magazine, P. Berggren 595,285
Camera, photographic, J. L. Atwater 595,551
Camera, photographic, W. F. Cook 595,468
Cannon, E. J. Blood 595,464
Cap, miner's, J. Beck 595,595
Car, center plate, J. Timms 595,681
Car coupling, De Lisle & Main 595,318
Car coupling, T. H. Simpson 595,351
Car fender, Farlow & Strayer 595,379
Car fender or guard, tram, O. A. Sutherland 595,356
Car fender or guard, tramway, J. F. Ayres 595,362
Car seat, H. S. Hale 595,624
Car seat, R. Rochester 595,415
Carbureter, N. Z. Seitz 595,658
Carriage, folding, Hall & Anderson 595,386
Carrier. See Bicycle luggage carrier. Hay carrier.
Cartridge feed belt, Benet & Mercie 595,518
Casing head packer, J. E. Martin 595,574
Caster, W. H. Coldwell 595,526
Chain, endless screw, J. Wolander 595,508
Chair. See Folding chair.
Chair attachment, I. B. Archer 595,450
Checkrein hook, J. T. Anderson 595,430
Checkrein hook, J. R. Gump 595,566
Chopper. See Cotton chopper.
Chopping machine, J. C. Hall 595,387
Chuck, L. Bartlett 595,363
Churn, A. Hazelton 595,627
Chute, stock, Mohler & Foltz 595,643
Cigarette machine, G. H. & F. D. Hayden 595,474
Clay, etc., machine for working, G. E. Taylor 595,357
Clevis, cross, J. L. Thomas 595,503
Coat and umbrella suspending rack, J. H. Chambers 595,670
Coat support, J. D. Watts 595,358
Coffin, E. L. Snader 595,461, 595,462
Coin box, B. F. Wyman 595,509
Comb gage attachment for scissors or shears, S. Goldner 595,470
Combination wrench, W. Devaun 595,289
Compass, draughting, F. Coykendall 595,607
Condiment box, Jenatschke & Fischer 595,481
Corn sheller, C. A. White 595,359
Corner block machine, E. Belden 595,463
Corset, I. M. Bond 595,554
Corset, C. W. Dodge 595,376
Corset stiffener, A. A. Adams 595,510
Cotton chopper, J. S. Lauderdale 595,397
Cotton stalk puller, J. Hall 595,456
Cotton stalk puller, B. F. Harwood 595,626
Coupling. See Car coupling. Pilot coupling. Pipe or tube coupling. Pump coupling.
Cover, kettle, H. H. Foreman 595,454
Crayon holder, F. M. Rugeley 595,498
Crutch, folding, E. O. Kuhnke 595,637
Cultivator, double, J. K. Deaton 595,674
Curtain rod bracket, E. H. Cram 595,560
Cuspidor, sanitary, W. C. & T. J. Kerrigan 595,313
Cycle safety bolt, A. Gobron 595,622
Cycle, three wheeled, T. E. Montgomery 595,490
Cyclometer, W. C. Homan 595,569
Dental apparatus, C. D. Grundy 595,301
Dental cuspidor, D. S. Doyle 595,532, 595,533
Digger. See Post hole digger. Potato digger.
Display rack and tray, folding, J. S. Baird 595,516
Door fastener, A. H. Wesling 595,505
Door hanger, P. L. Sheridan 595,550
Door holder, A. Adams 595,428
Draw bench, F. Deming 595,611
Drying frame, P. O'Thayne 595,648
Dumping apparatus, J. G. Delaney 595,528
Dye, anthrarufin, R. E. Schmidt 595,349
Dye from chrysazin, blue, R. E. Schmidt 595,350
Educational appliance, M. M. Glidden 595,455
Egg tester, E. Edwards 595,292
Electric cable joint, W. M. Brown 595,367
Electric currents, method of and apparatus for converting, E. Thomson 595,419
Electric machines, regulating alternating current dynamo, E. W. Rice, Jr 595,412
Electric meter, W. D. Marks 595,325
Electric meter prepayment attachment, Strachan & Niven 595,446
Electric motor, E. D. Priest 595,410
Electric motor controlling device, F. J. Russell 595,344
Electric regulator, M. Moskowitz 595,330
Electrical apparatus conductor, J. Millis 595,402
Electrical controlling mechanism, F. J. Russell 595,345
Electrical lighter for burners, S. M. Meyer 595,327
Electricity from car wheel axles, means for generating, M. Moskowitz 595,329
Elevator. See Grain elevator.
Elevator stop, automatic, Withers & Blackman 595,507
Elevators, automatic control device for, Merrill & Foley 595,326
Engine. See Fuel engine. Gas engine. Hoisting engine. Oil, gas, or like engine. Rotary engine. Rotary steam engine.
Engine or pump, D. Job 595,631
Exercising apparatus, B. A. McFadden 595,492
Exhibiting apparatus, P. & H. Roush 595,549
Extractor. See Nail extractor.
Extracts, making, Fromm & Schmidt 595,296

(Continued on page 412)

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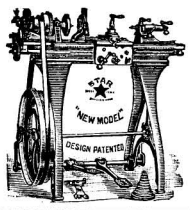

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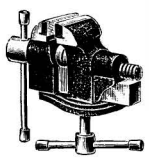

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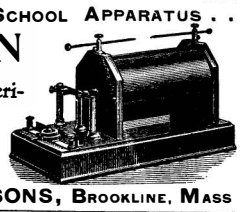

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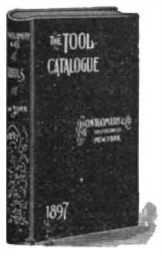

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Fence machine, wire and picket, J. T. Guthrie 595,623
Fence post, H. Buck 595,600
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Fifth wheel, vehicle, S. M. Wright 595,683
Fire escape, W. Fischer 595,453
Fire plug, E. C. Wiley 595,506
Fishing float, G. H. Wenger 595,664
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Fluid pressure regulator, P. Erb 595,614
Fluid pressure regulator, A. Heithecker 595,540
Folding chair, I. G. Leek 595,316
Foot warmer, J. P. Berchem 595,519
Frame. See Drying frame.
Fruit picker, J. W. Downey 595,531
Fuel, artificial, J. T. Davis 595,672, 595,673
Fuel engine, MacFadden & Lloyd 595,324
Furnace. See Boiler furnace. Hot air furnace. Metallurgical furnace.
Fuse block, D. A. Schutt 595,585
Gage, E. H. Byer 595,370
Galvano cautery instrument, C. MacGregor 595,573
Game apparatus, R. S. & F. B. Crooks 595,372
Game apparatus, biblical, W. S. James 595,440
Garment hanger, C. H. Garrigus 595,564
Gas burner, E. Lindner 595,317
Gas engine, A. L. Harbison 595,625
Gas engine, E. Meredith 595,489
Gas generator, acetylene, Choquette & Morin 595,451
Gas machine, acetylene, H. Bryant 595,668
Gasolene motor, Banki & Csonka 595,552
Gate, A. G. Duncan 595,377
Gear wheels, manufacture of, D. S. Bissell 595,553
Generator. See Gas generator. Steam generator.
Gin saw sharpening machine, J. M. Bradley 595,520
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Grain tank, E. D. Johnston 595,310
Grate, hollow blast revoluble, Payne & Joubert 595,649
Hammock, I. E. Palmer 595,335
Hammock attachment, I. E. Palmer 595,336, 595,337
Hanger. See Garment hanger.
Harvester, corn, F. Hixson 595,477
Harvesting machine, W. W. Burson 595,369
Hat bodies, apparatus for manufacturing fur, E. T. Robinson 595,582
Hat fastener, H. Ingram 595,480
Hat fastener, King & Burns 595,483
Hay carrier, R. Gregg 595,385
Heater. See Water heater.
Heating apparatus, F. F. Edgar 595,378
Hoisting device, A. C. Dinkey 595,561
Hoisting drum, U. S. James 595,308
Hoisting engine, variable speed, O. Crosby 595,671
Hook. See Checkrein hook.
Horse power machine brake, T. P. Chambers 595,522
Horseshoe attachment, F. Hurop 595,305
Horseshoe, nailless clamping, J. J. A. Miller 595,401
Hose bridge, J. F. Morrison 595,645
Hot air furnace, S. Dewhirst 595,436
Illuminating device for keyholes, Roll & Waltman 595,444
Incubator, H. R. Foster 595,381
Indicator. See Boiler water indicator. Signal indicator.
Insulated joint for gas fixtures, J. W. Parkin 595,338
Jig for drilling bolt holes, M. H. McArthey 595,404
Knife. See Bread knife.
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Latch, A. Adams ..... 595,424 to 595,427
Latch, gate, J. A. Green 595,676
Lathe, change gear, E. J. Flather 595,562
Lathe slide, Cheney & Comstock 595,288
Leather dressing machine, S. Chadwick 595,669
Leather manufacturing apparatus, D. Hays 595,303, 595,304
Lifter. See Plate lifter.
Lightning rods, tubular tripod brace for, G. R. Kress 595,543
Limb, artificial, J. H. King 595,634
Link, connecting, O. Klatte 595,542
Liquids, portable vessel for retailing, E. Lychenheim 595,323
Lock. See Bicycle lock. Sash lock.
Lock, Crouch & Stokes 595,606
Lock, T. Dowman 595,290
Locomotive fuel saving device, C. B. Lord 595,321
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Manhole cover, J. J. O'Brien 595,647
Measuring pole, R. Hegarty 595,475
Metallurgical furnace, N. McConnell 595,646
Meter. See Electric meter.
Mill. See Rolling mill. Stamp mill.
Mining gold bearing placers, system of, W. F. Lay 595,458
Mirrors or transoms, friction pivot for, C. P. Dyer 595,613
Mixer, B. J. Spilker 595,354
Moistener for envelopes, etc., W. M. Moseley 595,491
Motor. See Electric motor. Gasolene motor. Railway motor. Spring motor.
Motors, braking alternating current induction, E. W. Rice, Jr 595,413
Musical instrument, G. A. Brachhausen 595,366
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Pavement, wood, H. Freese 595,616
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Photographic printing, timing apparatus for, E. Buhler 595,368
Piano damper, A. Nickel 595,458
Picker. See Fruit picker.
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Pipe. See Tobacco pipe.
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Railway, electric, J. R. Farmer 595,293
Railway motor, electric, E. D. Priest 595,409
Railway signal, W. J. Fawcett 595,294
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Sad iron support, H. Reno 595,411
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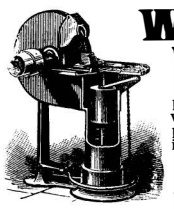
Saddle horn, J. W. Haggard 595,567
Sand drag, revolving, J. Murphy 595,442

(Continued on page 415)



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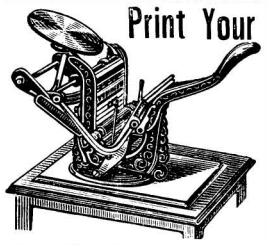

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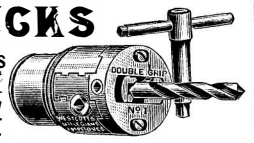

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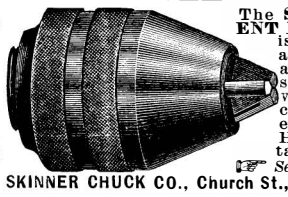

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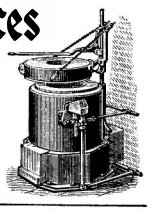

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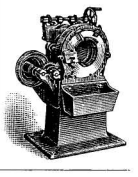

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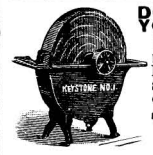

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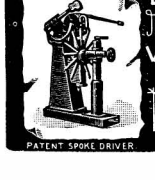

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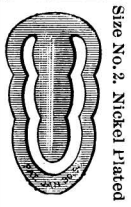

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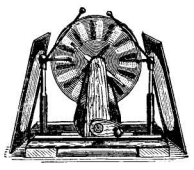

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ILLUSTRATIONS.

A

Acetylene bicycle lamp..... 308
Acetylene gas buoy..... 389
Africa, archæological discovery. 315
Air brake instruction car..... 117
Air compressor, Flindall's..... 201
Air motor, Cooper's..... 356
Alarm, burglar, novel..... 180
Alaska, passes of..... 180
American Association..... 89
Animal holding device..... 196
Ankle brace for skaters..... 181
Ants, parasites of..... 251
Arch Rock, San Francisco..... 171
Army balloon, Parseval..... 10
Asphalt paving..... 216
Astoria Hotel..273, 281, 282
Axle improvement..... 212
Axle skim machine..... 276

B

Bailey torpedo boat..... 395
Balloon, aluminum.....405, 406
Balloon Deutschland..... 57
Balloon, the Parseval..... 10
Ballroom ceiling..... 281
Baths, Roman..... 25
Beads, window, improved..... 214
Bearing plate, rail..... 246
Beer pipe cleaner..... 164
Beet sugar apparatus..... 65
Bicycle brake..... 58
Bicycle brake, Bullard..... 378
Bicycle brake, Hart's..... 36
Bicycle brake, Morrow..... 292
Bicycle brake, new..... 6
Bicycle, chainless..... 262
Bicycle, chainless, Columbia..... 277
Bicycle factory, modern.....289, 292
Bicycle lamp..... 20
Bicycle lamp, acetylene..... 308
Bicycle, new type of..... 356
Bicycle riding, trick..... 55
Bicycle sail attachment..... 27
Bicycle support..... 228
Bicycle tire, Hamp's..... 20
Bicycle tire pump..... 372
Bicycle work, brazer for..... 20
Bins, grain, steel..... 401
Black art, the..... 123
Blood corpuscles..... 75
Blooming mill..... 312
Boat, roller, latest..... 310
Boat, umbrella..... 149
Boiler house, sugar works..... 73
Boiler tube cleaner..... 245
Boiler tube, corrosion of..... 168
Bolts and screws..... 133
Book carriers, library.....113, 120
Borer, angle, McCoy's..... 201
Bottle, non-refillable.....132, 164
Bottle washer, Kersten's..... 27
Brake, air, instruction car..... 117
Brake, bicycle..... 58
Brake, bicycle, Bullard..... 378
Brake, bicycle, Hart's..... 36
Brake, bicycle, Morrow..... 292
Brake, bicycle, new..... 6
Brake, hydraulic..... 33
Brazer for bicycle work..... 20
Brazing apparatus..... 201
Bridge, East River.....81, 91
Bridge, Harlem River.....33, 41, 42
Bridge renewal, rapid..... 293
Bronze, art, casting of..... 299
Brooklyn, cruiser, drill on.....104, 105
Brougham, horseless..... 85
Bullet lubricator..... 20
Bullets, expanding..... 181
Buoy, acetylene..... 389
Burglar alarm, novel..... 180
Burglars' tools..... 228
Burner, Bunsen..... 149
Burner, gas, improved..... 340
Burner, gas, self-closing..... 201
Burner, hydrocarbon..... 27

C

Cabs, electric, London..... 197
Caissons of East River bridge... 81
Camera, hand, Adlake..... 264
Camera, hand, Ray..... 324
Camphor, artificial, apparatus.... 27
Camping utensils..... 36
Candlestick, pneumatic..... 228
Can washing machine..... 27
Car, air brake..... 117
Car coupling, Smith's..... 298
Car, motor, steam..... 344
Car truck, Weston's..... 324
Carriage, motor, Winton..... 52
Carthage, Punic tomb at..... 315
Casting of art bronze..... 299
Ceiling, ballroom..... 281
Cells, prison, steel..... 345
Chain limbering machine..... 289
Chain riveting machine..... 289
Chair, folding, new..... 84
Chair, rocking, combination..... 84
Chameleon, American..... 267
Chilkoot Pass, the..... 180
Chimes, Grace Chapel..... 49
Cigar lighter, Brooke's..... 27
Circle divider, new..... 43
Circuit closer..... 201
Clamp, jeweler's..... 326
Clock, tower, electric..... 49
Clothes washer, new..... 324
Clutches, improved..... 212
Collar, spirit..... 139
Concentrator for mining..... 164
Concentrator, Moore's..... 276
Condenser, Snell's..... 148
Coolers, grain..... 325
Corking device..... 148
Corner piece..... 150
Cottage, a suburban..... 134
Coupling, car, Smith's..... 298
Couplings, tube, welding..... 398
Cover for mucilage bottles..... 340
Crank, bicycle..... 292
Crank profiling machine..... 289
Cruiser Brooklyn, drill on.....104, 106
Cruisers for Japan..... 343
Crystallizers, sugar..... 73
Custom house, X rays in..... 88
Cycle tires, pump for..... 372

D

Dam, irrigating, Hemet..... 200
Dance of Tusayans..... 362
Destroyer, torpedo boat..... 376
Dock, dry, Brooklyn navy yard.. 408
409
Dock, dry, Havana..... 248
Dogs, Esquimau..... 241
Drawbridge, Harlem River, 33, 41, 42
Drill, burglar's..... 228
Drill for hub flanges..... 289
Drill, Hatton's..... 308
Drill in U. S. Navy.....104, 105
Diving dress, novel..... 377
Dry dock, Havana..... 248
Dynamo, a small.....161, 165
Dynamo electric machine..... 27
Dynamo, hand, new..... 245

E

East River bridge.....81, 91
Electrocution, illusion of..... 379
Elevator accident, New York.... 215
Elevator, fall of an..... 199
Elevator, grain, steel..... 401
Elevators, floating..... 325
Elevators, grain..... 321
Embankments, sliding..... 309
Empress Queen, steamer..... 261
Engine and boiler, Schmidt's.... 201
Engine, rotary..... 27
Engine, vapor, Wright..... 56
Engines of ship Massachusetts, 209, 213
Engineers, civil, new home of... 358
Esquimau man and boy..... 241
Esquimaux, group of..... 249
Expedition, Nile, gunboat..... 331
Expedition, Peary, return..... 241

F

Farms, lost and regained..... 40
Feed water regulator..... 27
Feet of Chinese women..... 361
Ferryboat for Nova Scotia..... 280
Ferryboat Pere Marquette..... 121
Filter beds, Lambertville..... 68
Filter presses..... 72
Filteration, water..... 68
Fire box partition..... 308
Fire drill, school.....360, 361
Fish, a flying..... 59
Fish plates, rail..... 212
Flooring materials, tests..... 6
Flowers, magic..... 283
Flue cleaner, Jones'..... 260
Formicary, a..... 251
Foundations, submerged..... 107
Frame, bicycle, pneu. cushion.... 404
Friction clutches..... 212
Furnace, portable..... 232

G

Gage and cutter, glass..... 196
Garbage, New York, disposal. 97, 102
Gas, acetylene, lamp..... 308
Gas burner, improved..... 340
Gas burner, self-closing..... 201
Gas exhausting apparatus..... 201
Gas main stopper..... 262
Gate hinge, Choate's..... 388
Gears, bevel, cutting..... 277
Gibbs, Prof. Oliver W..... 89
Gill, Prof. Theo. N..... 89
Glass cutter, Seiter's..... 196
Governor and speed indicator... 260
Grain coolers..... 325
Grain, handling, at New York.. 321
Grain mill..... 372
Graphophone, low priced..... 375
Graving dock, Havana..... 248
Guitar, the orchestral.....137, 138
Gumming apparatus..... 201
Gun, "knock-down"..... 408
Gunboats for Nile expedition.... 331

H

Hammers, nail device for..... 122
Handle bar adjustment..... 292
Handle bar, bicycle..... 201
Harlem River drawbridge....33, 41, 42
Harvey, Hayward A..... 153
Hinge, gate, Choate's..... 388
Holder, stovepipe, Griswold's.... 404
Holtz machine, large..... 203
Horseshoe pad..... 132
Hose nozzle..... 260
House, a Pompeiian..... 219
House, Pueblo..... 153
Howard, Leland O..... 195
Hub attaching device..... 212
Hub, bicycle..... 292
Humming birds, tame..... 217

I

Illusion, "Gone"..... 379
Indians, Yakish..... 11
Influence machine, Holtz..... 203
Inventions, new..... 201
Inventions, recent.....27, 260

J

Jewelry, clamp for..... 326

K

Kaiser Wilhelm der Grosse..... 229
Kelvin, Lord..... 259
Kineoptoscope, Wray's..... 388
King of Siam..... 203
Kitchen, Pompeiian..... 219
Klondike, railway to..... 278

L

Lachine Rapids power plant..... 353
Lamp, bicycle..... 20
Lamp, bicycle, acetylene..... 308
Lamp, dark room..... 230
Lantern, Monarch..... 388
Lathe, foot, improved..... 182
Launch, hunting..... 56
Lawn mower, gasoline..... 314
Lawn sprinkler..... 164
Library, Congressional, new.113, 120
Life saving device..... 294
Light, electric plant..... 225
Lime kilns..... 72
Lizards, color changes in..... 267
Lock, nut, Hartman's..... 132
Locomotive, Heilmann.....145, 152
Locomotive, mountain..... 331
Locomotive of N. E. RR. car.... 344
Lubricator, bullet..... 20

M

Magic flowers..... 283
Magic table..... 75
Mail catcher, Ayars..... 116
Mail catcher, railway.....100, 167
Mail tube, pneumatic.....369, 373, 374
Mask, Carthaginian..... 21
Massachusetts, engines of.... 209, 213
Mayer, Alfred M..... 74
Metempsycbosis..... 186
Meteorite, great..... 241
Micromotoscope..... 75
Mill, grain..... 372
Monument, William I..... 235
Mosaic from Tunis..... 315
Motion, perpetual..... 311
Motor, air, Cooper's..... 356
Mould to solder pipes..... 341
Mountain railway..... 299
Mower, lawn, gasoline..... 314
Mucilage bottle cover..... 340
Mutoscope, Casler..... 260

N

Nail holder, hammer..... 122
Nansen, Dr..... 297
Natacka ceremony..... 363
Navy, U. S., drill in.....104, 105
Net holder for fire use..... 294
Nile expedition, gunboat..... 331
Nut lock, Hartman's..... 132

O

Oil can, new..... 201
Oil field, Los Angeles..... 37
Oil wells, boring at sea..... 341
Ore concentrator, Moore's..... 276
Oven and stove, portable..... 36

P

Pad, horseshoe..... 132
Parasites of ants..... 251
Paving, asphalt..... 216
Pear tree, remarkable..... 21
Peary expedition, return..... 241
Peary, Robert E..... 249
Pelican rookery, great..... 280
Pere Marquette, ferryboat..... 121
Perpetual motion..... 311
Petroleum, California..... 341
Petroleum stove..... 232
Petroleum wells, Los Angeles... 37
Pipe cleaning apparatus..... 164
Pipe testing machine.....393, 394
Pipe, tobacco, absorbent..... 84
Pipe, tobacco, Hannaford's..... 181
Pipes, soldering..... 341
Pipes, steel.....385, 392, 393, 394
Plant protector, Taylor's..... 20
Plow, snow, rotary..... 17
Postal box, Beach..... 373
Postal tube, pneumatic...369, 373, 374
Powder, smokeless..... 181
Power plant, Lachine Rapids.... 353
Power plant, Rheinfelden....328, 329, 330
Prison construction, steel..345, 346
Projector, picture..... 388
Propeller, auxiliary..... 260
Propellers, bronze..... 229
Pueblo house..... 153
Pulverizer, ball..... 27
Pump for rubber tires..... 372
Pyramids, problems of..... 391

R

Rail and rail fastening..... 212
Rail joint support..... 246
Railroad, N. Y. C., disaster..... 309
Railroad tie, Miller's..... 196
Railroad to Yukon valley..... 278
Railway mail catcher.....100, 116, 168
Railway signal, new..... 71
Railway, single rail..... 299
Railway switch, automatic..... 7
Railway, underground, Boston, 177, 184, 185
Range finders, new..... 148
Rays, X, in Custom house..... 88
Redwood trees, giant..... 347
Refuse, city, disposal...129, 136, 137
Refuse, New York, disposal...97, 102
Rheinfelden power plant..... 329
Rifle, Savage..... 181
Riveting machine..... 289
Roller boat, the latest..... 310
Rolling mill..... 312
Rookery, pelican, great..... 280
Rope test..... 139
Rotifer, movements of..... 75
Rotunda of Congress Library.... 113

S

Saddle bar, Olans..... 201
Sandblast, use of the..... 232
Sash holding device..... 214
Saw blade plates, cleaning..... 52
Scale removing apparatus..... 52
School fire drill.....360, 361
School, textile, Lowell..... 244
Seat post, bicycle..... 201
Seismograph, Marvin..... 85
Shafts, support for..... 260
Shaker, grate, Strob's..... 196
Shaking screen for wheat..... 321
Sheep holder, Ralston's..... 196
Siam, King of..... 203
Signal, railway crossing..... 71
Skeleton, paper..... 123
Slot machine..... 289
Snow plow, rotary..... 17
Soldering iron, Barber's..... 356
Soldering pipes, mould for..... 341
Sounding board, Livingston's.... 27
Speed indicator..... 260
Spiritualistic post test..... 155
Spiritualistic ties..... 139
Spoke header..... 289
Spraying apparatus, Black's..... 76
Sprinkler for lawns..... 164
Stack, book, carrier..... 121
Statues, bronze, casting..... 299
Steam trap, Heintz..... 68
Steamer Empress Queen..... 261
Steamboat, lengthening a.....337, 342
Steel tubing.....385, 392, 393, 394
Steel tubing, manufacture....305, 312, 313
Steel tubing works.....257, 265, 266
Stove and oven, portable..... 36
Stove, petroleum..... 232
Stoves, partition for..... 308
Subway, Boston, new.....177, 184, 185
Sugar, beet, apparatus..... 65
Swing, steel, Bausman's..... 7
Switch railway, automatic..... 7
Switch, time, automatic..... 372

T

Table, dining, redwood..... 347
Table, magic..... 75
Testing machine, hydraulic..393, 394
Textile school, Lowell..... 244
Thunderbolt, a destructive..... 37
Tie, railroad, Miller's..... 196
Ties, spiritualistic..... 139
Time switch, automatic..... 372
Tire, bicycle, Hamp's..... 20
Tires, rubber, pump for..... 372
Tobacco pipe, improved..... 181
Tobacco pipe, new..... 84
Tomb, Punic, at Carthage..... 315
Torpedo boat catcher..... 395
Torpedo boat, trial of..... 376
Torpedo, firing a..... 155
Tower clock, electric..... 49
Trap, insect..... 251
Trap, steam, Heintz..... 68
Trestle, improved..... 52
Trick riding..... 53
Trolley lines, New York.....69, 70
Trolley road wagon..... 296
Trolley, Van Depoele..... 107
Truck, car, Weston's..... 324
Tube, boiler, corrosion of..... 168
Tube, letter, Beach..... 373
Tubing steel, manufacture...385, 392, 393, 394
Tubing, steel, works.....257, 265, 266
305, 312, 313
Tug of war, 1849..... 376
Tuna of the Pacific..... 59
Turbines and generators, Hartford.....225, 233, 234
Turbines, notable.....193, 198
Tusayan Indians, the..... 362
Typewriter, Rem-Sho..... 388

U

Umbrella boat..... 149

V

Valve, an improved..... 27
Valve, reversing..... 148
Valve, slide, balanced..... 132
Valve testing device..... 6
Victoria regia..... 217

W

Wagon axles, machine for..... 276
Wagon, road, trolley..... 296
Warehouses, grain storage..... 321
Washing machine, Pitzler's..... 324
Waste, New York, disposal...129, 136, 137
Water filtration..... 68
Weir, automatic..... 340
Wells, oil, boring at sea..... 341
Wheat crop, handling.....321, 325
William I, monument..... 235
Window beads, improved..... 214
Winged Victory, figurehead..... 7
Woolen spinning..... 244
Wrench, monkey, Avery's..... 404

Y

Yachts, steam, notable..... 24
Yakish Indians, the..... 11
Yukon valley, railroad to..... 278

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

A

Acetylene, bicycle lamp.....*308
Acetylene gas buoy.....*389
Acetylene gas exhibition..... 356
Acetylene gas explosion..... 263
Acetylene for heating tests..... 327
Acetylene for signaling..... 326
Acetylene, use of..... 202
Acid, salicylic, in food..... 99
Aeroplane, experiments with..... 214
Africa, archæological discovery.*315
Africa, Central, trade with..... 199
Africa, exploration in..... 323
Air and athletics..... 246
Air brake instruction car.....*117
Air compressor, Flindall's.....*202
Air, liquid, possibilities..... 118
Air motor, Cooper's.....*356
Airship crosses to France..... 267
Alarm, burglar, novel.....*180
Alaska, gold fields of..... 98
Alaska, notes on..... 196
Alaska, passes of.....*180
Alaska, railroad in..... 262
Alaska, reindeer of..... 151
Albadermine (7.71)..... 13
Alcock, Sir R., death of..... 343
Alcohol, dehydrated..... 155
Alcohol and mountain climbers.. 71
Aluminum, present price of..... 377
Ambulances, trolley car..... 389
American Association, the....83, *89, 131
American Institute Fair.....243, 263
Ancients, extravagance of..... 139
Ancients, wealth of..... 314
Andree, hunting for..... 74
Andree starts north..... 51
Angle borer.....*202
Animal holding device.....*196
Animal species, number of..... 86
Animals, dark, on mountains.... 247
Animals, domestic, Peru..... 150
Animals, effect of cold on..... 268
Animals, insanity in..... 7
Animals and plants vital proc... 162
Ankle brace for skaters.....*181
Ant shelters..... 294
Antiques, Egyptian, bogus..... 375
Antiquity of man in America.... 162
Ants, parasites of.....*251
Arch Rock, San Francisco.....*171
Archæological news..147, 150, 170, 259
Archæological news, recent..... 390
Archæological notes..... 406
Archæology, notes on..... 375
Architects, ancient, pay..... 390
Architects, naval, Congress..... 250
Archives, government's costly.. 105
Argentine medicine law..... 275
Argon and water, compound of.. 55
Armature, dynamo.....*164
Armor plant, government..... 370
Armor plate compromise..... 34
Armor plate question..... 402
Army balloon, Parseval..... *10
Art, landscape..... 154
Art, scientific truth in..... 162
Artillery fire, inaccuracy of..... 34
Artillery force, increase of..... 343
Artillery, increase of, needed.. 306
Asphalt paving.....*216
Association, British 135, 146, 162
Asteroids, new..... 214
Astoria Hotel.....*281
Attorneys, patent, methods..... 114
Australian Science Association.. 214
Austria, railroads of..... 250
Authors, prices paid to..... 276
Automobile race in France..... 83
Axle improvement.....*212
Axle skim machine.....*276

B

Bacillus of baldness..... 170
Bacteria, have they uses?..... 8
Bacteriology, study, danger..... 231
Bailey, torpedo boat.....*394
Baku, naphtha industry of..... 379
Balboa, statue of..... 378
Baldness, bacillus of..... 170
Ballast, brought in..... 246
Balloon, aluminum, Berlin.....*405
Balloon crosses the Channel..... 267
Balloon, expedition, Andree's, 150, 163
Balloon, the Parseval..... *10
Balloon, Woelfert, explosion.... *57
Baltic-Black Sea Canal..... 43
Barbers, Paris, restrictions on.. 183
Basslisk and Niger, ships.....*376
Bath tub, Versailles Palace..... 378
Bathing and catarrhal disease... 188
Baths, Roman..... *25
Battery, storage, the..... 387
Bazin roller boat, the..... 274
Be good to yourself..... 154
Beads, window, improved.....*214
Bearing plate, rail.....*246
Beer pipe cleaner.....*164
Beet sugar farm and factory..... 130
Beet sugar industry.....322, 323, 399
Beet sugar industry, Nebraska.. 407
Beet sugar, manufacture of..... *72
Beekeeping and honey..... 167
Beetles that destroy lead..... 246
Bertillon system..... 107
Beverages, alcoholic, France..... 356
Biart, Lucien, death of..... 180
Bicycle, 200 miles a day on..... 18
Bicycle brake.....*58
Bicycle brake, new..... *6
Bicycle brake, Bullard.....*378
Bicycle brake, Hart's..... *36
Bicycle brake, Morrow.....*292
Bicycle, chainless 179, *262
Bicycle, chainless, Columbia.....*277
Bicycle factory, a large.....*292
Bicycle lamp..... *20
Bicycle lamp, acetylene.....*308
Bicycle, new type of.....*356
Bicycle speed, fast..... 214
Bicycle support.....*228
Bicycle tire cement..... 56
Bicycle tire, Hamp's..... *20
Bicycle tire pump.....*372
Bicycle trick riding..... *53
Bicycle work, brazer for..... *20
Bicycles used in France..... 211
Bicycling vs. obesity..... 55
Bicyclists, dietary of..... 371
Bicyclists, caution to..... 21
Birds, colors of..... 140
Birds, electricity in..... 122
Bismuth blue..... 278
Black art, the.....*123
Blind, ribbon books for..... 105
Blood corpuscles..... *75
Blood corpuscles, counting..... 103
Blood corpuscles, formation..... 183
Boat, roller, Knapp.....201, 391
Boat, roller, the latest.....*310
Boat, roller, problem of..... 274
Boat, torpedo, British.....*376
Boat, tor., submarine, Fulton's.. 404
Boat, umbrella.....*149
Boats, station announcers on..... 235
Body, action of potash on..... 262
Boiler tube cleaner.....*245
Boiler tube, corrosion of.....*168
Bone black, oxidizing power.. .. 231
Book carriers, library..... *13
Book, the smallest..... 170
Books free of duty..... 55
Books, germs in..... 138
Books, new..... 410
Books, rare, sales of..... 218
Books, ribbon, for the blind..... 105
Borax..... 346
Borghese treasures..... 57
Boston subway.....*184
Bottle, non-refillable.....*132, *164
Brake, air, instruction car.....*117
Brake, bicycle..... *58
Brake, bicycle, Bullard.....*378
Brake, bicycle, Hart's..... *36
Brake, bicycle, Morrow.....*292
Brake, bicycle, new *6
Brain, effect of worry on..... 168
Brazer, gasoline..... *20
Brazing apparatus..... *202
Bricks, cost of..... 139
Bricks, efflorescence in..... 311
Bricks, hollow, Roman..... 375
Bridge, East River..... *91
Bridge of fence wire..... 50
Bridge, Harlem River..... *41
Bridge renewal, rapid.....*293
Bridge, St. Lawrence..... 4
British Association.....135, 146, 162
Bronze, art, casting of.....*299
Brougham, horseless..... *85
Buildings, dustless..... 403
Bullet lubricator..... *20
Bullets, expanding.....*181
Buoy, acetylene gas.....*389
Burglar alarm, novel.....*180
Burglar's tools.....*228
Burner, gas, Barney's.....*202
Burner, gas, improved.....*340
Burner, gas, incandescent..... 356
Burner, Bunsen.....*149
Burners, gas, incandescent..... 356
Butterflies, costly..... 371

C

Cable to Iceland..... 283
Cabs, electric, London.....152, *197
Calcium carbide, value..... 147
Camel, speed of the..... 186
Camera, hand, novel.....*264
Camera, hand, Ray.....*324
Camera, largest in world..... 53
Camp utensils..... *36
Canal at Massena..... 394
Canal destroyed by gophers..... 54
Canal, Joseph's, Egypt..... 138
Canal, Panama, condition of..... 164
Canal, ship, Baltic..... 43
Canal, ship, Florida..... 219
Canal, ship, proposed..... 354
Canal, St. Lawrence River..... 394
Candlestick, pneumatic.....*228
Cannon, big, casting..... 119
Carbon and iron, union of..... 103
Carbon dioxide in plant forcing.. 55
Carborundum, new use of..... 23
Car coupler, law..... .267, 274
Car coupling, patents..... 204
Car coupling, Smith's.....*298
Car, instruction, air brake.....*117
Car, motor, future of..... 55
Car, motor, palace..... 358
Car motor, steam.....*344
Car truck, Weston's.....*324
Cars, electric, loss in stoppage... 360
Carriage, motor, Winton.....*52
Carriages, automobile, race..... 83
Carriages, horseless, burned..... 55
Carriages, motor, race of..... 135
Carthage, discoveries at.....*21, 168
Carthage, Punic tomb at.....*315
Cape and town, saving a..... 118
Casting of art bronze.....*299
Castings, shrinkage..... 149
Cavalcaselle, G. B., death of..... 375
Caucasus, excursion to..... 307
Celebration, electric, Maine..... 118
Cells, prison, steel.....*345
Cement, bicycle tire..... 56
Cement for glass..... 343
Cement for leather and metal... 326
Cements, caoutchouc and gutta percha..... 404
Chair, folding, new.....*84
Chair, rocking, combination..... *84
Chalk, black..... 331
Chameleon, American.....*267
Charcoal, animal, deox. power... 231
Chateau of Malmaison..... 170
Chemist, noted, death of..... 5
Chemistry, literature of..... 246
Children, education of..... 251
Chilkoot Pass, the.....*180
Chimes, Grace Chapel..... *49
Christmas Island expedition..... 230
Chrome glue as a glass cement... 343
Churches, buried, Cornwall..... 43
Circle divider, new..... *43
Circuit closer, new.....*202
City, Greek, unearthed..... 377
Civil service examinations..... 83
Clamp, jeweler's.....*326
Climate and crime..... 227
Clock, Grace Chapel..... *49
Clothes washer, Pitzler's.....*324
Clouds, drifting of..... 74
Clouds, printing in..... 240
Clutches, transmission.....*212
Coal from China..... 133
Coal production of world..... 340
Collar, the spirit.....*139
Collection, the Field..... 277
Collodion, manufacture of..... 278
Color blindness..... 298
Color changes in lizards..... 267
Colors from tungstates..... 326
Colors of birds..... 140
Colors of the races..... 214
Coloring matter of plants..... 71
Column of building stones..... 361
Commerce Commiss., Interstate. 306
Concentrator for mining.....*164
Concentrator, Moore's.....*276
Condenser, Snell's.....*148
Conglomerates of New England. 122
Copper objects, Egyptian..... 170
Copyright injustice..... 403
Copyrights, new register of..... 70
Cordite case, appeal in..... 82
Cordite for quick fire guns..... 215
Corking device.....*148
Corner piece.....*150
Cottage, suburban.....*134
Cotton crop, our great..... 275
Coupler, automatic, law..... 267
Coupler law, enforcement..... 274
Coupling, car, Smith's.....*298
Cover for mucilage bottles.....*340
Cramp's annual report..... 186
Crime and climate..... 227
Criminals, identifying..... 107
Critical points..... 390
Crocodile mummy, a..... 11
Cruisers for Japan..... *3
Crystals, large..... 9
Currents, electric, effects..... 246
Custom house, X rays in..... *88
Cycle brake, new..... *6
Cycle tire, pump for.....*372
Cycles, chainless..... 179
Cycles, motor, race of..... 135
Cyclists, dietary of..... 371
Cymric, steamer..... 263
Cypress swamps, deep..... 311

D

Dam, irrigating, Hemet.....*200
Death, sudden, causes of..... 105
Decision, an important.....*106
Degeneration, stigmata of..... 250
Destroyer, torpedo boat.....*376
Details, economy in..... 402
Developer, a new..... 300
Developer, Hoover's (7241)..... 333
Developer, photo,, new..... 390
Diamidoresorcine..... 390
Diamonds, artificial, production. 183
Diamonds, Crookes on..... 60
Dietz, Robert E..... 219
Diphenal developer..... 300
Disease germs in soils..... 132
Disinfectant, lead nitrate as..... 122
Disinfecting books..... 138
Diving bell, improved..... 169
Diving suit, novel.....*377
Divining rods in England..... 22
Doane, Thomas, death of..... 295
Dock, dry, Brooklyn..... 140
Dock, dry, Brooklyn navy yard, repairing.....*408
Dock, dry, Havana.....*247
Dock, dry, problem..... 227
Dock, graving, Havana..... 387
Dog, anecdote of a..... 315
Dogs attacking cyclists..... 122
Door spring, the..... 56
Drawbridge, Harlem River..... *41
Drill, burglar's.....*228
Drill, Hatton's.....*308

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Drill in U. S. Navy *104
Dry dock, Brooklyn 130
Dry dock, Havana *247
Dry dock problem 227
Dust and clearness of air 187
Dwarfs and giants 60
Dynamite, electric firing 300
Dynamo, hand, new *245
Dynamo, small, how to make *161

E

Earthquakes, do they vary? 100
East River bridge *91
Ebonite, transparency of 84
Economy, lesson in 212
Educator, the American 347
Eggs, duck, black 375
Eggs, uses in medicine 36
Egypt, discoveries in 266
Egypt, population of 346
Electrical show, New York 267
Electricity, contact 124
Electricity, what is it? 163
Electrocution, illusion of *379
Element, a new 169
Elevator accident, New York 215
Elevator, fall of an *193
Elevator, grain, fireproof *401
Elevator, modern, safety 194
Elevator, runaway, a 242
Elevators abroad 406
Ellide, steam yacht 8
Ellide, yacht, speed of 390
Embankments, sliding *309
Empress Queen, steamer *261
Emulsions to kill insects 55
Engine and boiler, Schmidt's *201
Engine, pumping, large 11
Engines of ship Massachusetts *213
Engineers, civil, new home *338
Engineers, electrical, meeting 55
Engineers, licensing 258
Evans, Sir John *101
Examinations, civil service 83
Excavations at Treves 150
Exhibition, electrical, N. Y. 267
Exhibition, Prison Assoc 258
Exhibitions of 1896 38
Expedition, Antarctic 99
Expedition, Bottego's 375
Expedition, Christmas Island 230
Expedition, Ellice Islands 375
Expedition, Jackson, return 167
Expedition, Nile, gunboats *330
Expedition, North Pole 326
Expedition, Patagonian 262
Expedition, Peary, return of *241
Expedition, polar, Wellman 199
Expedition, Schauensfeld 375
Expedition, North Pole 35
Exploration, Arctic, organized 343
Explorations, Asiatic and African 183
Explosives, multiplication of 275
Exposition, Nebraska 154
Exposition, Pan-American 119
Exposition, Paris, 1900 147
Extravagance, ancient 139
Eye, fatigue of 87
Eye sanitation 170
Eye sight and electric light 19

F

Fabric, a peculiar 359
Face, expression of the 119
Fair, American Institute 243, 263
Farm lands, recovery of *39
Farm, model, for China 133
Farm weeds, troublesome 172
Fauna and flora, Arctic 330
Fear of lightning, the 122
Fear, psychogenesis of 188
Fear, the cult of 375
Feather evil 405
Feet of Chinese women *331
Ferryboat for Nova Scotia ..... * 79
Ferryboat Pere Marquette *121
Fever, typhoid, vaccination 359
Fever, yellow, remedy for 263
Fevers, treatment of 55
Field, Cyrus W., collection 277
Figures, some startling 155
Filtration, water *68
Fire box partition *308
Fire drill, school *360
Fire extinguisher, simple 60
Fire extinguishment, school of 178
Fire flies, photo. energy 163
Fire, great, in London 255
Fire, how it causes death 154
Fire in cold storage vault 55
Fire net holder *294
Fireproof wood 326
Fish, flying, of California *59
Fish plates, improved *212
Fishes, tuberculous disease 346
Fishes, venomous 42
Fishing, night, electric light 103
Flight, equilibrium in 103
Floods in Germany, recent 204
Flour, compressed 407
Flower, the largest 183
Flowers and grasses, preserving 343
Flowers, change of color 327
Flowers, coloration of, artificial 378
Flowers, magic *283
Flowers, perfume of 135
Fluc cleaner, Jones' *260
Fluorine, liquefaction of 8, 262
Fly, parasites of the 327
Fly wheel, bursting of 71
Flying without wings 84
Focus tube rays 314
Fog, dangers, lessening 169
Fog, London 330
Food adulteration, novel 359
Food of bicyclists 371
Food, salicylic acid in 99
Forms, migration of 311
Foundations, submerged *107
Frame, bicycle pneu cushion *404
Franklin, house of, in Passy 58
Franks, Sir A. W., death of 170
Freckles, removal (7171) 13
Fresenius, Prof., death of 5
Friction clutches *212
Fruit flavors 230
Fuel oil, trial of 99
Fuel supply, the world's 147
Fulgurite, a large 9
Fungi, preservation of 186
Furnace, portable *282

G

Gage and cutter, glass *196
Ganymede, rotation of 122
Garbage, city, utilization of *102
Gas, acetylene explosion of 263
Gas burner, Barney's *201
Gas burner, improved *340
Gas burners, incandescent 356
Gas exhausting apparatus *231
Gas lighting devices 372
Gas main stopper *262
Gases in air of mines 187
Gate hinge, Choate's *388
Gears, bevel, cutting *277
Gears, guides in 101
Germs, disease, in soils 132
Germs in books 138
Geographical Society, new home 283
Geography 147
Geological Congress, Intern *211, 307
Geological excursion, Ararat *324
Geology of Yukon region 171
Ghosts, scientific view of 42
Giants and dwarfs 60
Gibbs, Prof. Oliver W *89
Gill, Prof. Theo. N *89
Gimlet screw, inventor of 183
Glacial fauna and flora 330
Glacier eruption, remarkable 9
Glasgow without taxation 5
Glass, cement for 243
Glass cutter, Seiter's *196
Glow worms, light of 163
Glue, chrome 343
Glycerine, perfumed, for hair 359
Gold fields, Alaskan 98
Gold in the sea 116
Gold toning 227
Gophers destroy a canal 54
Government without taxation 4
Governor, Rader's *260
Grain, handling, New York *325
Grain mill *372
Graphophone, Eagle *375
Grasses and flowers, preserving 343
Gravehals tunnel 382
Graving dock, Havana *247
Grenades, hand, how made 60
Greyhound, Atlantic, latest *229
Guides in gears 101
Guitar, orchestral *137
Gumming apparatus *202
Gun, a big, casting of 119
Gun carriage, disappearing 35
Gunboats for Nile expedition *331

H

Hager, Prof. H. J., death of 279
Hair, glycerine for the 359
Hair, use of the 186
Hairs, cross, in transits 202
Hammers, nail holder for *122
Hand grenades, how made 60
Handle bar, bicycle *202
Harlem River bridge *41
Harvey, Hayward A *133
Havana graving dock 387
Health don'ts 250
Heart bur als 75
Heart, influence music on 197
Heavens for August 67
Heavens for December 355
Heavens for July 9
Heavens for November 279
Heavens for October 215
Heavens for September 135
Heidelberg castle, age of 390
Heraldry, Indian 313
Hinge, gate, Choate's *388
Hub attaching device *212
Hudson Bay, to by rail 311
Hudson River tunnel 98
Human structure 147
Humming birds, tame *217
Hyposulphites, eliminating 298

I

Ice breaking steamer, an 344
Iceland cable to 288
Illissus, excavations on 390
Illuminant, a new 356
Illusion, "Gone" *379
India rubber substitutes 196
Indiana Academy of Sciences 183
Indian heraldry 313
Indian, origin of the 195
Indians, Tusayan *362
Indians, Yukish, last of *11
Influence machine, Holtz *203
Ink, indelible 359
Ink, stamping 278
Inks, dangerous 107
Inks, printing 343
Insanity in animals 7
Insects, annual battle with 23
Insects, labor saving 214
Invention, what it has done 294
Inventions, great 139
Inventions, new *201
Inventions, recent *26, *260
Inventions, recently patented, 12, 28, 44, 60, 76, 92, 108, 124, 140, 156, 172, 188, 204, 220, 252, 269, 284, 300, 316, 332, 348, 363, 380, 395, 396, 406, 410
Inventor, the oldest 170
Inventors, warning to 387
Iron, hot, and carbon dioxide 117
Iron trade, the American 146
Ironwork, cleaning *232
Island of Bornholm 231
Ivory, history of 295

J

Jackson expedition, return 167
Japan 38
Journals in foreign languages 90

K

Kaiser Wilhelm der Grosse *229
Kaiser Wilhelm, new record 243
Kaiser Wilhelm, steamer 387
Kelvin, Lord *259
Kinematograph, novel use 375
Kineoptoscope, Wray's *388
King of Siam *208
Kite balloon, Parseval *10
Kite flying, high 212
Kite signaling 43
Kite, Weather Bureau 294
Klondike gold regions 98
Klondike, railway to *278
Klondike region, map of 389
Klondike, wealth of the 263
Knots converted into miles 87

L

Laboratories, scientific, modern 35
Laboring classes of Mexico 386
Lace, the different kinds 53
Lachine Rapids power plant *357
Lake village, Celtic 390
Lakes, Swiss, depths of 390
Lamp, bicycle *20
Lamp, bicycle, acetylene *308
Lamp, dark room 135, *230
Lamp, phosphorescent, Pulu's 83
Landmark, engineering, remov 402
Landor mission, failure of 359
Landscape art 154
Landslide, curious 231
Lands, public, vacant 5
Lantern, Monarch *388
Lantern pictures 359
Lantern slides, developing 218
Lasso, the 403
Lathe, foot, improved *182
Launch, hunting *56
Law, Argentine, on medicines 275
Law, automatic coupler 267
Law, car coupler 274
Law, patent, amendments 210
Law, patent, changes 227, 370
Law, patent, the new 387
Laws, trade mark, Swedish 275
Lawn mower, gasoline *314
Lawn sprinkler *164
Lawyer crop, American 186
Lead nitrate as disinfectant 122
Leather, fixing to metal 326
Leather, photographs upon 36
Leather, waterproofing 278
Length, standards of 87
Librarian of Congress, new 19
Library, Congressional *113
Library, Menelik's 138
Library, new, Washington 99
Library, New York Public 324
Library of electrical books 195
Life, Arctic, in glacial times 330
Life saving device *294
Light, city, from refuse 51
Light, electric, and eyesight 19
Light, electric, Hartford *233
Lighthouse, Penmarch 268
Lighting devices, distance 372
Lighting, vaccum tube 34
Lightning averted by smoke 341
Lightning, effect on oak *37
Lightning, thunder and fear 122
Lightning, trees and 186
Lightship at Hateras 228
Literature chemical 246
Lizards, color changes in *267
Lock, nut, Hartman's *132
Locomotive counterbalance *115
Locomotive, Heilmann *152
Locomotive, mountain *331
Locomotives in Japan 101
London fog 390
London, great fire in 355
Looks of people 119
Lubricator, bullet *20

M

Maasdam, ship, accident 344
Machinery, sectionalized 379
Machinery, U. S., in Germany 359
Machines, polish for 359
Machinist, the American 50
Madder root 298
Magic flowers *283
Magic, new book on 179
Magnesium, atomic weight 279
Magnetism, earth's, variations 162
Mail catcher, Ayars *116
Mail catcher, railway *100, *168
Mail service, pneumatic tube 67
Mail service, rapid, new 19
Mail tube system 373
Malpighi, monument to 296
Man, mental evolution 179
Manganese in trees 390
Manufacturers, hint to 358
Manuscripts, alteration in 315
Manuscripts, old, finds of 390
Manuscripts, restoration of 183
Manuscripts, sale of 102
Map, a tapestry 150
Marble, black, artificial 372
Marble, coloring 101
Marine, merchant, statistics 5
Mask, Carthaginian *21, 168
Massachusetts, engines of *213
Massena, canal at 394
Mastodon, discovery of 246
Materials, building, testing 100
Mathematics 147
Mauna Loa, life on 199
Mayer, Alfred M *74
Mayer, Prof., death of 51
McClure, Prof., death of 99
Medal to Scientific American 310
Medical Congress, International 231
Medicine, sales, Argentine law 275
Medicines, origin of 21
Memory, measurement of 376
Menander, a lost play of 390
Menelik, library of 138
Mesa, enchanted, Mexico 214
Mesa, Prof. Libbey conquers 83
Metal, a new 169
Metals, castings, shrinkage 149
Metals, fatigue of 4
Metals, the precious 90
Metempsychosis *187
Meteorite, story of a 327
Meters, electric 162
Mexico, laboring classes of 386
Mice, driving away 84
Microbe of seborrhœa 170
Microbes, note on 327
Micromotoscope *75
Migration of things 311
Milk, Pasteurizing 151
Mill, grain *372
Mills House, the 291
Mineral waters 134
Minerals, two new 327
Mining, placer, concentrator for, *164, *276
Mitchell, Maria, bust of 11
Mont Blanc, recov. of body on 181
Monument to Lord Leighton 170
Monument to Malpighi 296
Monument to William I *235
Mortality, rate of 170
Mosaic from Tunis *315
Mosquito remedy 20
Mosquitoes 300
Motion, perpetual *311
Motor, air, Cooper's *356
Mould to solder pipes *341
Mount Mayon, eruption 122
Mount Saint Elias, ascent 147
Mount Vesuvius, eruption of 7
Mount Washington, preserving 23
Mountain, Rocky, climbing 116
Mountains and color forms 247
Movements controlled by ideas 371
Mower, lawn, gasoline *314
Mucilage bottle cover *340
Mucilage (7262) 380
Mummy, crocodile 10
Mummy of Pharaoh 154
Museum, British, visitors 390
Music, influence of 197
Mutoscope, Casler *260

N

Nail holder, hammer *122
Nail, old, in old wood 20
Nansen, Dr., arrival of *297
Nansen's outfit here 260
Naphtha industry, Baku 379
Nationality and scenery 246
Nature as an educator 251
Natural history notes 186
Navy, U. S., drill in *104
Navy vessels, number of 375
Navies, United States and Spain 290
Nebraska Exposition 154
Negatives, washing 298
Negligence, what constitutes 151
Nerves, effects of drugs on 162
Net holder for fire use *294
New York harbor improvement 34
New York, port, commerce 82
Night season, influence of 87
Nile expedition, gunboats *330
Nile Valley, discoveries in 266
Nobel bequest to science 19
North Pole, quest of 338
Notes and queries 411
Nut lock, Hartman's *132

O

Obesity 67
Observatory, Yerkes 52, 278
Occupations of Americans 73
Oil can, Bell's *202
Oil fuel, trial of 99
Oil wells, boring at sea *341
Oils, spontaneous combustion 359
Old age pensions, Germany 132
Oranges, improved varieties 54
Ordnance, heavy, new method *408
Ore concentrator, Moore's *276
Oven and stove, portable *36
Oysters, artificial 359
Ozone, atmospheric 70
Ozone, phosphorescence of 36

P

Pad, horseshoe *132
Palace of Pharaoh, discov 259
Palisades, preservaton of 227
Panama Canal's condition 164
Paper, wall, arsen cal 276
Parasites of ants *251
Parasites of the fly 327
Parian chronicle, discovery of 170
Paris bazar fire 164
Paris Exposition, 1900 147
Parthenon inscrip. deciphered 83
Patent attorneys, methods 114
Patent attorneys, registration 115
Patent business, fraudulent 82
Patent competition, disrep 170
Patent decisions, recent 8
Patent firm disbarred 210, 226
Patent issue, a record 291
Patent law amendments 210
Patent law changes 227, 370
Patent law, the new 387
Patent Office reform 327
Patent Office reform needed 267, 295
Patent Office reform, urgent 291
Patent Office rules abrogated 4
Patent Office rules, new 354
Patent practice, fraudulent 242
Patents, American, recent *27
Patents, lottery induced 19
Patents of Pat. Office employes 119
Patents, old, curious 370
Patentees, dodge to defraud 323
Paving, asphalt *216
Pear tree, remarkable *21
Peary expedition, return of *241
Peary off for Greenland 75
Peary party, return of 214
Peary, Lieut., in England 387
Peary, Lieut., receives a ship 403
Peary, Robert E *249
Peat bogs of East Friesland 55
Pelican rookery, great *280
Pen, electric light 291
Penmarch lighthouse 268
Pension roll, a big 134
Pensions, old age 132
Pensions, U. S., for one year 195
Pere Marquette, ferryboat *121
Perfume in flowers 135
Perpetual motion *311
Perspiration, toxicity of 55
Petroleum, California *341
Petroleum stove *252
Petroleum wells, Los Angeles *37
Pharaoh, mummy of a 154
Pharaoh, palace of 259
Philippium, new element 169
Phonograph, application of 359
Phosphorescence of ozone 36
Phosphorescence in plants 231
Photochronograph, new 310
Photography, submarine 74
Photographs, intensifying 390
Photographs, luminous 182
Photographs on watch cases 393
Photographs upon leather 36
Phthisis, serum for 279
Physicians, congress of 163
Physicians of the United States 86
Physics 147
Pictures for the lantern 359
Pictures, Lady Wallace's 150
Pile driving, obstruction to 198
Pipe cleaning apparatus *164
Pipe, steel, industry *265, *312, *392
Pipe, tobacco, Hannaford's *181
Pipe, tobacco, new *84
Pipes, flush your 234
Pipes, soldering, mould for *341
Pith of sunflower 170
Plague, bubonic 73
Plague, serum for 246
Planetoids, discovery of 87
Plant protector, Taylor's *20
Plants, forcing 55
Plants, sleep of 151
Plants that give light 231
Platinum, electric resistance 115
Platinum toning 227
Polar expedition, Wellman 199
Polar problem, the 86
Polish, machinery 359
Port of New York, commerce 82
Postal service, N. Y., improved 181
Postal tube, pneumatic 243
Postal tube system *373
Postoffice fraud order, issue 323
Post test, spiritualistic 155
Powder, smokeless *181
Power, electric, Richmond 118
Power plant, Lachine Rapids *357
Power plant, Rheinfelden *329
Power station, a great 258
Power transmission *212
Power, water, age of 291
Power, water, utilization 347
Presidents, cause of death 135
Printing in clouds 230
Printing inks 343
Prison Association exhibition 258
Prison construction, steel *345
Projector, picture *388
Propeller, auxiliary *260
Propeller, repairing a 162
Prosperity 114
Psychogenesis of fear 188
Pueblo house *265, *392
Pullman, George M., death of 278
Pump for tires *372
Pump, the largest 11
Pyramids, problems of *391

R

Race of automobile carriages 83
Race of motor cycles 135
Races, colors of 214
Radiographs, taking 310
Rail deflections, photographing 71
Rail joint support *46
Rail, third, in England 34
Rails and rail fastening *212
Rails, expansion of 9
Rails for wagon roads 98, 248
Railroad building, fast 8
Railroad in Alaska 262
Railroad, N. Y. C., disaster 290, *309
Railroad speed, fast 75
Railroad tie, Miller's *196
Railroad to Hudson Bay 311
Railroad to Yukon valley *278
Railroads, electricity on 322
Railroads of Austria 250
Railway crossing signal *71
Railway in China 163
Railway, inclined plane 283
Railway mail catcher *100, *116, *168
Railway, single rail *299
Railway speed, fast 99
Railway switch, automatic *7
Railway, underground, Boston, 163, *184
Railways, electric, New York 178
Railways, electric, of Europe 231
Range finders, new *148
Rapid transit, New York 194, 338
Rapid transit scheme, a 242
Rats in Scilly Islands 122
Rattlesnake poisoning 359
Rays, X, and glowworm light 163
Rays, X, exam. of painting by 9
Rays, X, for photog. flowers 38
Rays from focus tubes 314
Rays, X, in Custom house *88
Rays, X, in mining 53
Rays, X, study of 279
Recipes 278
Recipes and notes 359
Recipes, miscellaneous 326
Recipes, various 343
Redwood trees, giant *347
Refuse, city, disposal *136
Refuse destructor plant 43
Reindeer of Alaska 151
Relics of Nansen expedition 260
Report of the War Office 354
Report Secretary of Interior 338
Respiration, influ. of music on 197
Rheinfelden power plant *329
Ribbon books for the blind 105
Riding, weight reduced by 55
Rifle, Savage *181
Rinderpest 122
River Scheldt, bed 326
Roads built too fast 8
Roads, country, wagon tracks on 98
Rockies, climbing the 116
Roeblingite, new mineral 7
Roentgen and his rays 54
Roentgen Society, a 150
Roller boat, Knapp's 391
Roller boat problem 274
Roller boat, the latest *310
Rooms, damp, test of 91
Rotifers *75
Rubber substitutes 196

S

Saddle bar, Wooster's *201
Salt habit, the 296
Salvage appliances 73
Sand blast to clean iron *242
Sandstone, efflorescence in 311
Sash holding device *214
Saw blade plates, cleaning *52
Scale removing apparatus *52
School fire drill *360
School of fire extinguishment 178
School, textile, Lowell *244
Schools, medical, of U. States 86
Schutzenberger, Prof., death of 71
Science, modern, advance of 119
Science, Nobel's bequest to 18
Science notes, 9, 23, 38, 55, 71, 87, 102, 122, 150, 170, 188, 202, 214, 231, 236, 246, 279, 298, 310, 327, 343, 359, 375, 390, 406
Science utilizes whole ox 228
Scientific American in Russia 152
Scrap pile, treasures of 390
Screw, gimlet, inventor of 183
Sculptor, profits of 155
Seat post, bicycle *201
Secretary of Interior report 338
Secretary of War, report 354
Secretions of umbelliferæ 71
Seed, distribution of 69
Seismograph, Marvin *85
Serum for phthisis 279
Shafts, support for *260
Shaker, grate, Stroh's *196
Sheep holder, Ralston's *196
Ship canal, Baltic 43
Ship canal, Florida 219
Ship canal, proposed 354
Ship Maasdam, accident 344
Ships, ballasting of 246
Ships, war, in fleet practice 178
Siam, King of *203
Signal, railway crossing *71
Signaling, acetylene for 326
Signaling by kite 43
Silicon carbide in steel manuf 137
Simpson, James E., death of 323
Skeleton, paper *123
Sleep, how to go to 179
Sleep, inducing, new method 405
Slides, lantern, toning 218
Smithsonian, questions asked 59
Smoke and storms 57
Smoke per ton of fuel 343
Snake poison, antidotes for 359
Snow, fighting, on railroads *22
Snow in balls 298
Sociology, experiment in 291
Soils, supporting power 202
Soldering iron Barber's *356
Soldering pipes, mould for *341
South America, our trade with 114
Southampton, record, new 182
Speed and endurance, human 402
Speed indicator *260
Speed, ocean, fast 387
Spiders and their prey 23
Spiritualistic post test *155
Spiritualistic ties *139
Spots, red, on plants 327
Spraying apparatus, Black's *36
Spring, the door 56
Sprinkler for lawns *164
Station announcers, Seine 235
Station, central, great 258
Station, Grand Central 149
Statistical research 86
Statue of Tubal Cain 260
Statues, bronze, casting *299
Steamboat, lengthening a *337
Steamer Cymric 263
Steamer Empress Queen *261
Steamer, ice breaking 344
Steamer Kaiser Wilhelm 243
Steamer, stern wheel, voyage 115
Steam saver, efficient *68
Steam trap, Heintz *68
Steam turbine, the 386
Steamer Kaiser Wilhelm 387
Steamship Company, Paci., new 331
Steamships, tug between *376
Steel for tubes, manufacture *312
Steel pipe industry *265, *392
Steel, manuf., silicon carbide in 137
Steel wagon tracks on country roads 98
Stimulants, nerve, abuse of 70
Stone, building, column of 361
Stones, coloring 101
Storage battery, the 387
Stove and oven, portable *36
Stove, petroleum *232
Stoves, partition for *308
Strawberry growth, prolific 87
Street railways, electric 178
Streets, French, lighting 158
Strikes in Great Britain 327
Strontium, discovery of 341
Students of German universities 150
St. Lawrence bridge 4
St. Lawrence, deepening 19
St. Lawrence River canal 394
Subway, Boston *184
Subway, Boston open 163
Substance, lightest known 170
Sugar and muscular exertion 298
Sugar, beet, farm and factory 130
Sugar, beet, industry 322, 323, 339
Sugar, beet, manufacture *72
Sugar industry of United States 66
Sun dial, prize for 58
Sun, eclipse, 1898 310
Sunflower pith 170
Sunstrokes in New Orleans 73
Superstition concerning figures 85
Surgical operation, novel 282
Surgical operations, time 148
Surveys, geological, U. S. 202
Swamps, cypress, deep 311
Sweden, trade marks in 275
Swiss lakes, depths of 390
Switch, railway, automatic *7
Switch, time, automatic *372
Synchronograph experiments 231
Syncope at high altitudes 310

T

Table, dining, redwood *347
Table, magic *75
Tallow tree, a new 295
Tan, removal of (7171) 13
Tank for model ships 344
Tanks, large, collapse of 375
Telegraph cable to Iceland 283
Telegraph system, sextuplex 99
Telegraphy without wires 298
Telescope, new, Greenwich 55
Temple of Wingless Victory 375
Temple, Roman discovery 375
Tension, high, and altitudes 310
Textile school, Lowell *244
Theater of Orange 150
Thermo-element, new 150
Thermopylæ, discoveries at 170
Thunder bolt, destructive *37
Thunder, lightning and fear 122
Tie, railroad, Miller's *196
Ties, spiritualistic *139
Time switch, automatic *372
Tire, bicycle, Hamp's *20
Tires, rubber, pump for *372
Tire cement 56
Titanium, metallic 9
Tobacco pipe, Hannaford's *181
Tobacco pipe, new *84
Tomb, Punic, at Carthage *315
Toning, platinum and gold 227
Toning solutions, photo *218
Tools, American, in Germany 359
Torpedo boat catcher *394
Torpedo boat trial *376
Torpedo, firing a *155
Tortoise of the Seychelles 327
Tortoise shell, imitation 359
Town and cape, saving a 118
Trackways for wagons, steel 248
Traction, electric, high speed 402
Trade, foreign, extension of 50
Trade mark decision, British 51
Trade mark decisions 8
Trade mark laws, Swedish 275
Trade marks, jeopardizing 66
Trade marks, registering 358, 375
Trade of South America 114
Trades unions, mediæval 75
Train, the fastest 99
Tramway line, Vienna 57
Transmission, electric 149
Transmission, power *212
Trap, steam, Heinz *68
Treasures, Borghese 37
Treasures of a scrap pile 390
Trees and lightning 186
Trestle, improved *52
Treves, excavations at 150
Trick riding *53
Tripe and onions 179
Trolley car ambulances 389
Trolley ride, a long 268
Trolley road wagon *296
Trolley system, New York *69
Trolley, Van Depoele *106
Truck, car, Weston's *324
Truffle, reproduction of 186
Tubal Cain, statue of 260
Tube, boiler, corrosion of *168
Tube, steel, industry *312, *392
Tuberculosis, cure for 375
Tuberculosis, pulmonary 251
Tubing, steel, manufacture *265
Tug of war, 1849 ..... *376
Tuna of the Pacific *59
Tunnel, Gravehals 389
Tunnel, Hudson River 98
Tunnel, rapid transit, New York 114
Turbine, steam, the 386
Turbines, a notable pair *193
Turbinia, latest performance 67
Turrets, warship, operating 310
Tusayan Katcinas *362
Typewriter, Rem-Sho *388

U

Umbelliferæ, secretions of 71
Umbrella boat *149
Umbrellas, care of 134
Universe, extent of the 124
University of California 119

V

Vaccination in England 246
Vacuum tube lighting 34
Value, instrinsic, is there? 246
Valve, reversing *148
Valve, slide, balanced *132
Valve testing device *6
Vaseline, testing 278
Vehicles, auto, in warfare 181
Vessels, merchant, of U. S 5
Victoria regia *217
Vistascope, Eddy's 167

W

Wagon, road, trolley *296
Wagon tracks on country roads 98
Wall paper, arsenical 276
War office report, annual 354
Warship turrets, operating 310
Warships in fleet practice 178
Washing machine, Pitzler's *324
Waste, New York, disposal *136
Watch case photographs 393
Watches, severe test for 134
Waterproof wood 326
Waterproofing leather 278
Water filtration *68
Water power, age of 291
Water power, utilization 347
Water, pure, does it pay? 245
Water, sterilization of 60
Water, sterilizing 103
Water supply of Greece 170
Water, the drinking of 106
Waters, mineral, as cures 134
Wealth, ancient 314
Weapons, war, modern 58
Weather Bureau exhibit, Paris 359
Weather Bureau, origin of 182
Weather Bureau, Switzerland 262
Weather predictions, astronom 105
Weather prognostications 51
Wedderburn disbarment 226
Weeds, how distributed 180
Weeds, troublesome 172
Weir, automatic *340
Wellman polar expedition 199
Wells, oil, boring at sea *341
West, Far, settlement of 5
Whale, death of, curious 83
Wheat as source prosperity 194
Wheat crop, handling the *325
Wheel, fly, bursting of 71
William I, monument *235
Window beads, improved *214
Wine from leaves 326
Winged Victory, figurehead *7
Wood for ship fittings 204
Wood, Prof. De Volson, death 19
Wood, to blacken 213
Wood, waterproof 326
Wrench, monkey, Avery's *404
Writer, superstition of a 85
Writing, antiquity of 186

Y

Yacht Ellide, speed of 390
Yacht, the fastest afloat 8
Yachts, steam, notable *24
Yakish Indians, last of *11
Year of plenty in Kansas 402
Yerkes Observatory 52, 278
Yosemite valley, survey of 214
Yukon region, geology 171
Yukon region map of 389
Yukon valley, railroad to *278

Z

Zola, superstition of 85
Zoological Garden, New York 356

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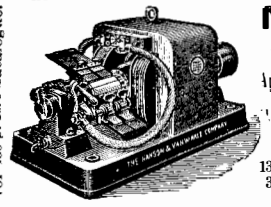

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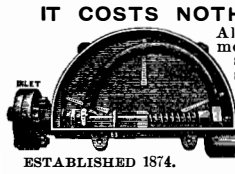

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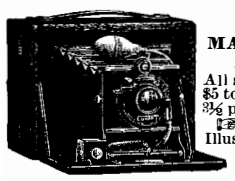

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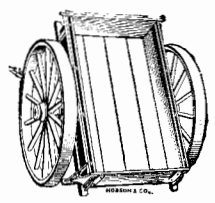

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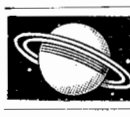

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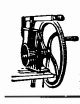

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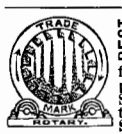

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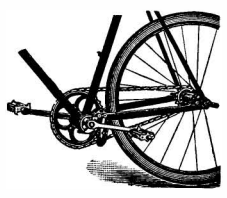

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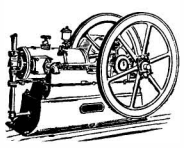

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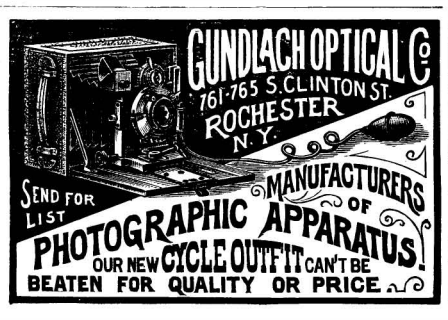

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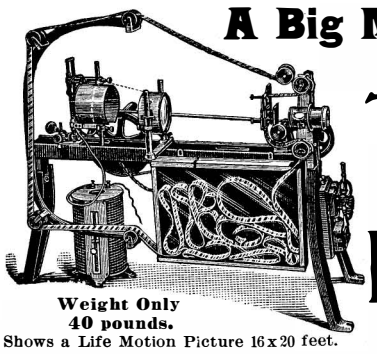

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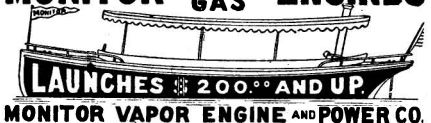

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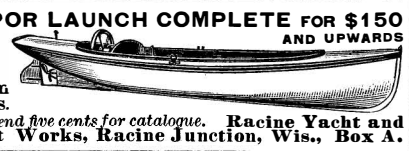

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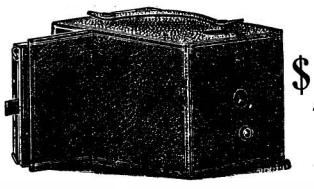

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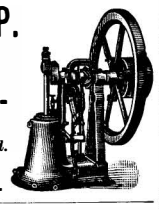

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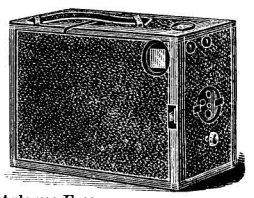

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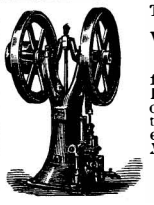

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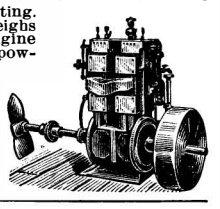

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